THE

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STEAM BOILER WORKING IN ELECTRICAL POWER STATIONS.

IN the paper read by Mr. J. W. Jackson before the Newcastle Local Section of the Institution of Electrical Engineers, we find much of interest, if not of novelty; but even though Mr. Jackson's paper is belated, there is still very good reason for it to have been written. We refer more especially to what he has to say on the combustion of bituminous fuels, a subject to which we have allotted very considerable space in these columns for at least 20 years, for a casual reference to our back numbers shows, among many other references, that the subject was dealt with on September 15th, 1893, September 19th, 1895, August 5th, 19th and 26th of 1898, August 30th, 1901, January 2nd, 1903, February 3rd and 17th, 1905, January 19th, 1906, and February 23rd, 1906. In these and many other articles and paragraphs, much of what is now advanced by Mr. Jackson has been dealt with thoroughly and in detail. We have contended that in order to ensure good combustion of bituminous coal, not only must there be air admission to the gases direct, but such furnace forms as shall secure that the air is thoroughly mixed with those gases, and that such admixture must obtain before the gases are cooled seriously by contact with boiler surfaces. The necessity of temperature conservation has been insisted upon, and the use of protective guards, linings, arches, &c., of refractory material to prevent heat loss and to store and give out heat, so as to minimise temperature fluctuation and provide a heat store to meet sudden outpourings of gas from freshly stoked coal.

The action of the mechanical stoker has been explained, and the faults of the once too common form of furnace of the water-tube boiler, as well as the possibilities of the water-tube boiler in the way of its applicability to sound forms of furnace, have been pointed out. The use of violet-blue glass has been explained in respect of flame intensity determination. Thus for over 20 years we have pursued this subject. What we said so long ago, Mr. Jackson is saying to-day, and he states that the principles all along advocated by us are now being more and more appreciated. This is well, so far as it goes, but is it not a pity that in so important a matter as fuel combustion it should require so very many years for "trained" engineers to awaken to the elementary principles of combustion and the means by which such principles should be carried out in practice?

Fifty years ago Roscoe and other lecturers on chemistry were showing how a spiral of platinum wire could be placed about the flame of a hydrocarbon candle so as to cause its rapid extinction. Yet this simple demonstration of the need for high temperature in burning hydrocarbon gases appears only to have been regarded as a curious phenomenon without practical value, for who wants to buy costly

platinum spirals when a tin cone will put out any candle more promptly? And so the tin cone, in the shape of water-cooled plates, has been used to extinguish bituminous coal flames, and is still so used, and the recognition of proper methods is still so rare that it is referred to by Mr. Jackson, who, at the foot of our page 780, uses words which are somewhere to be found in our columns since the year 1903. Search would doubtless discover them.

Even Mr. Jackson is apparently somewhat vague as to furnace forms to-day, for he speaks of the space between the grate and the tubes of the water-tube boiler having been too little 15 years ago. The trouble with the common setting that he is referring to was not so much the height as the fact that the gases rose vertically from the grate and ascended directly between the cold tubes—the platinum spiral of the lecture room. How, in such a furnace, could the gases be mixed with air?

Perfect combustion of bituminous coal gas may easily be secured by the use of a very long brick-lined furnace tube. Given an initially correct air admission, it is only a matter of sufficient length for every molecule of gas to meet its atoms of oxygen. In practice, abnormally long tubes of this order are not used. Practice adds a surplus of oxygen, and so far introduces the evil of a lower temperature, but it also ensures that each molecule of gas shall have a chance of meeting some atom of oxygen within a shorter path of travel. But practice has employed cold pathways, and these have been the most grievous error in boiler practice. Mechanical engineers who have studied the question have been unable to make their voices heard, for steam production has for 25 years been largely in the hands of men who were neither steam engineers nor furnace experts.

Of all the stations in London 10 years ago, we can call to mind only one in which bituminous coal-combustion received any attention. We hardly need say that we refer to Kensington.

Finally, we may refer to the suggested reduction to 200° F. of the furnace gas in order to allow of the latent heat of the steam, formed by the hydrogen, being recovered. When platinum is as cheap as copper, this may be done, but Mr. Jackson is suggesting a sulphuric acid bath for, presumably, steel boiler tubes. Has not Mr. Jackson ever seen an economiser fed with cold water, the lower ends of the pipes for about 18 in. being eaten away by this acid as the result of too cold a feed? Until sulphur can be otherwise eliminated, it will not be practicable to recover the said latent heat.

The Prestige of the Press.

From our list of Stock Exchange quotations, it may have been observed that the price of Reuter's shares has not wholly recovered the fall which followed the issue, and withdrawal, of the Agency's unfortunate circulars to the Press a month or so ago. Certain of the daily papers adopted an attitude of outraged virtue, and rather pompously paraded their zeal for the purity, the prestige of the Press. The sonority of the demonstration seemed sufficiently swelling to arouse mild surprise in the non-expert in these matters, who probably wondered what it all meant. The cynic perhaps had some excuse for his mistaken impression that the incident resembled the drum-banging which drowned the howls of the victims at the quack dentist's public performances. Others who are engaged in journalism, and who are equally concerned for its prestige—even if they prate about it less lustily—trusted that the incident might be provocative of needed reforms in certain departments of the newspaper world. Up to the present the reforms, if they have been made, have received much less advertisement than might have been expected after the righteous outbursts mentioned above.

Most of the financial papers frankly admit making a charge for the quotation of securities in which there is no official quotation and no free market. On the face of it, this candour might appear to disarm criticism. Most shareholders like to see some regular quotations for their stocks and shares. They might themselves demand that the board should pay, say, 100 guineas per annum, to this end, if the papers considered that the shares were of insufficient general interest to justify daily lineage being devoted to their gratuitous quotation. And if the Press were to indicate which were the quotations recorded as a matter of course, and which were paid for as a matter of expediency or advertisement, little could be said against the practice. A list of Stock Exchange prices, however, may be fairly regarded as on a par with Editorial news, and the inclusion amongst it of a number of paid-for quotations is patently undesirable. When it is further inquired whence the prices will in all likelihood be obtained—and if there is no free market, they must necessarily come from interested sources—the importance of separating the two classes of quotations becomes apparent. One of the financial papers puts a special mark against quotations that are charged for, and the system ought to be adopted by all journals accepting such advertisements.

The question whether meetings of shareholders should be reported in the Press without payment by the companies holding them, is unfortunately no longer a vexed one. Those who take the attitude that only by refusal of payment can the newspapers be expected to publish independent, free reports of meetings are in the small minority. Even the *Times* confesses that "reports of proceedings under the heading 'Company Meetings' are inserted as advertisements, *but* care is taken to ensure that they be trustworthy." The mere acknowledgment of the fact that care is taken to ensure trustworthiness carries the inference that the practice might otherwise be conceived to conceal at least the possibility of paid-for suppression of unpleasant details. Much food for reflection resides in the conjunction which we have taken the liberty of italicising in the above quotation.

These are but two of the ways in which it may occur to some that the vaunted prestige of the Press can sink at times to something far removed from the stars. The coincidence of favourable editorial comment upon something which "happens" to fill a full page of advertisement is no novelty. The demand for free calls of shares, the well-known device of the two editorial articles, one of which will appear, the unabashed offer of publicity masquerading as honest editorialism, the sale of unbiased opinion in order that by "obliging" some fount of information, a scoop may be effected when the chance offers—these and others of the same bastard brood of corruption are very much alive in the City to-day. It ought to be impossible to have a disguised puff inserted as a piece of news or comment, at a price. It ought to be impossible for any sort of editor to demand gold only—notes, cheques and calls declined—for inserting guileless-looking paragraphs that gild a flagrant advertisement. But these things are all too usual, and in a large section of the Press. The outsider may stumble against them by accident, and profess his disgust, his alarm, that such things can be. He will be met by the initiated by polite astonishment at his elementary ignorance. Cynicism and casuistry pat him patronisingly on the back as they defend to their complete satisfaction the degradation of a profession which will certainly never lack (newspaper) champions of its cherished honour and prestige.

The Parsons Turbine for Chicago.

We illustrate in our pages this week the 25,000-kw. turbo-alternator recently constructed and supplied by Messrs. C. A. Parsons & Co. for the Fisk Street station extension of the Chicago Commonwealth Edison Co. At the moment it is the biggest single-power unit ever constructed, and although this may be a fleeting honour, in view of the fact that the Commonwealth Co. also has a 30,000-kw. unit on order, yet it represents an achievement in turbine construction of which British engineers in general, and the makers in particular, have every reason to be proud. While Messrs. Parsons have had more and larger experience in turbine building than any other firm, it will be recognised

that so far the opportunities of English firms for building very large land turbines have been very few indeed, and it is therefore all the more a matter for congratulation that Messrs. Parsons have been able to show their ability to construct a turbo-alternator which is, in fact, the largest so far built.

Naturally the construction of such a machine introduced somewhat new problems, which, however, have been successfully overcome by the constructors, whose experience in large marine turbine work, as well as land turbines, is well-known. It is a matter for regret that the conditions of electricity supply in this country have not, in the view of those most interested, favoured the adoption of really large turbine units; the schemes which are maturing for railway and municipal power stations contemplate generating sets of only modest outputs, and, indeed, the 18,000-KW. turbine set which Messrs. Parsons are constructing for the London Underground Railways, and the 15,000-KW. set which is being installed by the Manchester Corporation, will apparently be the largest turbo-electric plants in use here for some time to come.

Lead.

THE market has hardly kept up the degree of buoyancy which has been for so long associated with it, and the feeling is beginning to gain ground that the trade reaction in progress is bound before long to make itself apparent upon the situation of lead. It cannot be overlooked that the deficiency in supplies from Mexico which arises directly from the revolutionary disturbances in that unfortunate country, has now been felt in full force, and that the world has been able to get along without Mexican lead. The price has, of course, shown the stringency arising from the lack of Mexican metal, but even this stringency is much less than might have been expected, when it is remembered how great stress has been laid upon the importance of the supplies coming from that quarter. The fact seems to be that other countries have given a little more freely, and that with trade receding the world can get along with rather less than seemed likely to be required. There is, at all events, no further talk of a scarcity akin to famine conditions, and it may be admitted freely that lead at considerably below to-day's figures would still stand at a good price. The general situation of the metal is, however, less favourable, and one rather significant thing is that important Missouri producers have recently been making close inquiries in the London market with the object of getting in touch with London conditions, for the purpose of selling lead here when the time seemed to be ripe. So far they do not appear to have done any actual business, but quite a considerable deal was proposed to leading interests here, and it may even yet mature. Much, of course, depends upon the tendency of affairs as regards Mexico and the United States, but the intention to sell American lead in Europe should not be dismissed as a matter of slight importance. Mexican lead has come recently into this country in small quantities, nothing of any consequence, however, and all appearances indicate that there will not be any serious renewal of shipments for a long time. The position of the mines and smelters is not thoroughly known here, owing to the difficulty of establishing communications, but as regards copper, it is perfectly clear that the mines in many cases are not working, and that owing to this the smelters are at a standstill. It is fair to presume that a somewhat similar state of things prevails as regards the lead industry. Recently the arrivals of lead here from abroad have been on a more liberal scale, but the position of the market has not been seriously prejudiced, though it would be well to take a rather more moderate view of the possibilities. The export demand has lessened latterly, which is only what is to be expected now that the shipping season to the Baltic and Canada has closed, and that in consequence the demand for lead for prompt dispatch has subsided, but at the same time quite a fair demand exists for near deliveries, for English consumers are but ill provided with material, and there is a continual succession of small demands which are required for immediate despatch, and for which buyers have to pay pretty high premiums. At the same time, the premium recently commanded by spot and near deliveries has been too high for complete satisfaction to be felt with the position, and an abatement of this is to be desired as a means of imparting a more sound appearance to the market. The outlook has certainly lost some of the recent strength, and unless there is to be a fresh curtailment of supplies in some at present unexpected direction, the probability is that things will gradually ease down. The market at present has a sloppy appearance, and it seems that confidence has been shaken pretty severely. Any materially advanced level of prices is unlikely now unless there should be fresh developments of an unfavourable nature as regards production, for consumption has managed to override the Mexican shortage, and all conditions now are of an easier character.

"Lest we Forget."

THE report of Major Pringle to the Board of Trade on the Aisgill disaster was issued on Tuesday, and bears out the views which we expressed at the time as to the lessons to be derived from the accident. The blame is laid principally upon Driver Caudle, whose excuses are brushed aside as insufficient reasons "for his neglect of the far more important duties of observation and caution."

The Inspector considers that there were two sources of fire—burning gas, and live cinders from the ash-pan—the first of which was successfully coped with. He again strongly urges upon railway companies the desirability of employing electricity as their standard illuminant, and while he admits that the cost of immediate conversion of the gas-lighted vehicles would be too great, he advises that all new stock shall be constructed with electric lighting, and all gas-lighted stock on main line and express services shall be replaced as early as possible, this policy being "in consonance with the trend of general practice all over the world, and one which is not impracticable from the point of expense." Perhaps Sir Guy Granet will now take steps to inform himself correctly as to what is being done abroad.

The Inspector is not yet prepared to recommend any of the cab-signalling systems that have been experimented with, and merely mentions the wireless control of trains; he is, of course, aware of the successful working of the system developed by Mr. H. von Kramer, which, in fact, is being installed on a section of the Midland Railway, and has been adopted on some German State railways, and perhaps when further experience has been gained he will be able to take up a more progressive attitude in this connection.

In the meantime Major Pringle suggests that the train stop in use on the London Electric Railways shall be tried, and if found reliable at high speeds, should be adopted.

There is no doubt that gas escaped from the cylinders under two of the wrecked coaches and ignited, and the Inspector points out that electric lighting, which is considered to-day the most desirable illuminant for high-class express trains, will in future be demanded as the standard system of train lighting, thus corroborating the views which we have put forward for many years. The lesson has been a bitter one; we trust that its teachings will not be forgotten.

Insulation Resistance.

MR. SYDNEY EVERSHED is to be congratulated upon the admirable paper which he has contributed to the proceedings of the Institution of Electrical Engineers, and of which an abstract is commenced elsewhere in this issue. It is in many ways a model of what a technical paper should be, and contains a great deal of information, much of which, no doubt, has been familiar in a general way to those engaged in the manufacture and use of electrical apparatus, but which is now for the first time subjected to the scientific method, and elevated to the status of "disciplined knowledge" by the application of accurate measurement and trained observation.

The author takes a modest view of the results which he has obtained, but it is clear that he has shed new light on the phenomena of leakage through insulators, and his work will undoubtedly be of immense benefit not only to those who employ the materials at present available, but also to those who are endeavouring to develop new and improved methods of insulating electrical conductors.

D

AMERICAN METHODS: AN INDICTMENT.

By F. W. D.

It is probable that many who read the recent interesting article entitled "American Methods are not Suitable for British Conditions" did so without deriving from it any clear idea of what American methods are. The writer of that article, who evidently realises that hardly any electrical men on this side of the water agree with him, claims that British gas engineers have accepted American methods whole-heartedly. Their enthusiasm is, no doubt, commendable; but this quality is not peculiarly American, though the form it sometimes takes may be.

A man's methods are the outcome of his philosophy—or the lack of it. The average American's philosophy is frankly materialistic, and he refers everything in life to the dollar standard. Self-assertive, boastful, and overbearing in his manner, he has, rightly or wrongly, come to be regarded as a type that must not be taken at face value. He conceives of no higher good than to control the wills of others. As a worker, his one ambition, if he has one, is to become a "boss"—the only one, if possible. True co-operation he does not believe in, and as a workman he cannot be relied upon to work his hardest, except under pressure. As a "boss" he will tackle no proposition that he cannot control; or, if he does, it will be with the idea of ultimately getting the control into his own hands. Of course, one knows full well that America has produced others, but the loud-voiced opinionated American is so predominant and advertises himself so persistently that by many he has been accepted as representative. American methods have a bearing upon the electrical industry in three aspects: financial, which affects the investor; industrial, as it concerns the employés; and commercial, as it relates to the consumer or customer.

American finance with its widely advertised prospectus—plausible, confident, and inviting—is usually noticeable by the attractive colours in which prospects are painted. Dividends—which are assumed to start from the very inception of the company—are usually estimated on a scale that will satisfy the most greedy investor. American finance is nothing if not monopolistic; and once a company is started an effort is usually made to eliminate competing concerns by means of a competitive warfare, which is good for neither companies nor the public. This usually impoverishes the company, and sometimes more capital is required. Often enough the market in the shares then goes to pieces, and the unfortunate shareholder parts with his shares at a nominal price. The majority of the shares are thus easily acquired by the promoters, who are then in a position to force a reconstruction, or a debenture issue at a high rate of interest, or other like financial operation, which, being outside the scope of this article, need not be further discussed. This cycle of events has happened so often to American investments—industrial concerns and mining ventures—and capital has so often been frittered away without materially benefiting any one save the "bosses" who controlled the market in the shares, that the British investor has become chary of them. It must, however, be admitted that it is on the financial side that British methods most nearly approach the American.

American methods in their application to industrial concerns usually involve some highly specialised system which practically eliminates all personal interest in the work for all except "the boss." No matter if the system costs more to carry out—and it usually does—than the problematical saving it effects, it accomplishes one thing, centralised control; but however attractive and scientific such systems may appear to be, they usually fail to justify themselves by financial results. Indeed, the cost of running the system is often no inconsiderable item. Such systems, having been tried, are usually discarded after a short run; otherwise those responsible for their introduction have had to fall back upon some modification of them. System, of course, there must be in every kind of industrial establishment; but the distinctively American systems are so unnecessarily elaborated that in some cases a special staff is required for their carrying out.

Mr. Seabrook, in his article, speaks of the "welfare work, contentment of, and improved conditions for workpeople, their proper feeding, housing, and so on," as though—forsooth—the workpeople were merely so many horses—or machines. A true man who is treated on such lines will not, and cannot, do the best work of which he is capable. His nature demands liberty; and, given a fair wage, he would infinitely prefer to look after his "proper feeding, housing and so on," himself. Rob him of the consciousness of liberty by needless restrictions on his conduct in the works and by fussy interference with his life outside, planning his dwelling as though it were part of a barracks, and his spirit will be stifled; he will lose his self-respect, and his whole being will suffer in consequence, as surely as his body would suffer were he denied fresh air. This ignorance of, and disregard for, human nature accounts to some extent for the discontent that exists among workpeople in works that pay attent "welfare work" on American lines. Obviously it cannot be t to men to decide what hours they will work, nor how much work they will do in a given time. When, however, the time in which he must complete each job is narrowly computed and specified to the workman, when any suggestions from him relating to the work are—if not actually forbidden—strongly discouraged, when he is watched at every turn by "inspectors," and when he is treated by the management with indifference or contempt, he will certainly not prove to be the efficient unit that the management with their so-called scientific organisation expect him to be. It may be freely acknowledged that no hard and fast rule can be enunciated as to what point the organisation should be carried to in any particular works; every case has to be settled with reference to its own particular circumstances. The relationships existing in British industrial concerns before American methods were introduced resulted in better work, and more of it, from staff and workpeople alike. Whatever economy has resulted from later methods is due to more economical designs and labour-saving machines—some of the latter admittedly of American origin; and not at all to American methods of dealing with the workpeople.

Coming now to the commercial end of a business, we see as its most salient feature that greater relative importance is attached to salesmanship than used to be the case. In the palmy days of electrical engineering, to make a good dynamo was more difficult than to sell it; and to maintain a continuous supply of electricity more difficult than to get a new consumer: now all that is changed; and to-day, owing to increased competition and other causes, the harder task is to sell your goods. The statement that "the man who can sell is worth more than the man who merely makes" is, however, one of those catch phrases that sometimes floor an unwary opponent in an argument without his knowing from whence the knock has come. A dogmatic statement such as this carries no conviction with it. One might transpose the words thus: "The man who can make is worth more than the man who merely sells." This looks as well in print, anyhow, and is just as convincing. The fact is, the Americans have exaggerated the present-day importance of salesmanship as they do everything else. The respective salaries drawn by the man who makes and the man who sells are determined by economic conditions which are not necessarily permanent, but may some day change again so as to give the advantage to the man who makes. Their respective salaries are no more an indication of their respective intrinsic values than the Stock Exchange quotations of any particular classes of shares are necessarily an indication of anything beyond the public demand for them for the time being. The methods of salesmanship presumably advocated by your contributor aim at influencing the good judgment of the public, the object of American advertisements being to impress upon the potential purchaser or consumer the desired idea by persistent and blatant reiteration. Leaflets, newspaper advertisements, sky signs, and other methods are all brought to bear upon a man's judgment, not by reasonable argument, but by sheer force of hypnotic suggestion. Such methods are a slur upon the intelligence of the people, and the better educated class resent it. It may be possible, by constant reiteration, and by constantly presenting the same suggestion in different forms, to fatigue—so to speak—the critical faculties, this being a form of hypnotism; and custom may

sometimes be secured in this way. These methods are out of line with the best traditions of British trading, and—apart altogether from the dignity of the thing—are not to be recommended, for it is only the novelty of the method that has ensured its success in the few instances where it has been tried. People will sooner or later take such methods at their true value.

There is, too, such a thing as self-hypnotism; and the apparently whole-hearted belief in themselves and their goods on the part of Americans—and, according to Mr. Seabrook, the British gas engineers also—should not be taken too seriously. The propect of an Americanised "boss" "leading to success the British electrical supply industry" is not altogether an inspiring one, nor is it likely to appeal to many readers of the Electrical Review. The renunciation of one's own judgment in technical matters and one's individuality, is repugnant to thinking men—and there are many in the electrical profession. In fact, it may be said that American methods generally are not likely to be permanently successful in this country, for its geography, its industrial conditions, and, above all, the temperament of its people, are not favourable to them.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Travelling Representatives.

Apropos the controversy under this heading, surely it is regrettable that even the slightest doubt should exist as to the necessity for the personal element in the development of sales.

Most certain it is that a travelling representative, as a sentient being, must know thoroughly the wares he wishes to flaunt before he can pretend to render the slightest assistance to his trade friends, for assuredly it is the salesman's mission to help the customer to buy rather than anything else he may strive to effect.

The ever-increasing variety of electrical material at the disposal of prospective purchasers, coupled with the indecision consequent thereupon, is in itself a stupendous justification for the travelling salesman.

The right kind of "ambassador" is of immense educative value to both those upon whom he calls and those whom he represents, and in spite of his present activity, his, it seems, is an object never completely accomplished.

That engineering is an exact science is agreed, and yet how unnecessarily large is the number of buyers of engineering material who omit the desirable degree of exactitude in their inquiries.

Apart from quite a large proportion of contracting engineers are numerous consulting experts, who seem habitually to neglect the necessity for even the slightest care with which solicitations for prices of material should be written or dictated. Consider the extensive variety of, say, switch and fuse gear, and yet who concerned with this important section of the trade will deny that it is commonplace to receive inquiries for switchgear without any indication of the type, finish, purpose, capacity, voltage, &c.? Here, then, is the necessity for the salesman who can "educate" his customers.

Even the perplexity which so often obtains at present as a result of vagueness in this connection would be tenfold or more, were it not for the fact that a representative in many cases is summoned by the customer to make recommendations, in order that the requirements may be intelligently conveyed to his principals.

This is by no means the whole case for the commercial traveller, nor would it be reasonable to try adequately to treat it in a communication of this length, but sufficient it is to say that in these remarks is embodied at least one important purpose of the salesman as a representative of the manufacturer whose aim it is to satisfy the demands of industrial progress.

P. O. Wittey.

Birmingham, *November 19th*, 1913.

Electrical Accidents in Mines.

The reports of mining accidents published in the last two numbers of this paper show that there is still room for improvement in the electrical equipment of some coal mines, and in the observance of rules and regulations in others. We shall always have the fool-hardy person among us who needlessly risks his own safety and often that of others. Such people will get into trouble, in spite of fool-proof apparatus and the most stringent and comprehensive rules.

Beyond those accidents due to men's carelessness, several others seem to be caused by damaged cables. It would be rather interesting to know the exact type of cable in use where these accidents happened. It is quite clear that damaged cables, whether main or trailing cables, are not unavoidable.

On page 732 the Inspector is quoted as saying that "trailing cables do not always receive the care they require." Again, on the same page, it is stated: "This is another instance where armoured cables would in all probability have prevented an accident." We do not suppose that many will dispute either of these statements. Whether a cable is slung in the roof of a working or laid on the floor as a trailing cable, if there is any chance of its being crushed that cable will most certainly be seriously damaged unless it is protected by some form of armour. The toughest covering short of an armouring, namely, lead, may not suffer greatly, but those types of cable which are generally used in mines, *i.e.*, V.I.R. and bitumen cables, are very easily damaged. A jute or leather braid is not sufficient protection for a trailing cable which is subject to constant abrasion on rough floors, to being trodden upon, and even wheeled over. Faults may easily occur inside a trailing cable without the outside giving any indication of it until someone touches it, as in the case reported in paragraph 8, page 733.

Trailing cables are now made with three or four types of protection; the cores are generally V.I.R. insulated (an earth wire simply braided sometimes accompanying them) and laid up, and wormed circular with jute, or vulcanised bitumen. The use of the latter material makes the cable waterproof, even if the outer coverings become porous. The cable is then finished with tapes and braided with jute or leather. As an alternative the outer braid is replaced by a spiral lapping of galvanised iron wires or strip.

On another type the cores are simply twisted, and wormed and sheathed with vulcanised rubber of a very tough quality. The first type (braided) is undoubtedly more liable to damage than either of the others. For the solid rubber-sheathed cable the makers claim immunity from abrasion and chemical action, but this is perhaps the most expensive form of protection. Personally, we favour the spiral-armoured cable as the most suitable for this class of work. If armouring is necessary to protect cables hung in the roof, how much more so is it for those which are pulled about, turned and twisted, and generally roughly handled on the floor!

Referring to the Inspector's statement that trailing cables do not always receive the care they require, we can readily believe this, but we would point out that after making full allowance for the natural difficulties under which these cables are used, it is not a difficult matter to ensure that they are properly looked after. For instance, if the coiling and uncoiling of the cable is carried out carelessly, the conductors are apt to kink, and in time burst the insulation. When not in use they should be coiled up carefully and put aside.

We note that in one case a machine man was left to repair a concentric cable, and we quite agree that such a repair should only be carried out by a competent electrician. Repairs of this kind, whether to concentrics or multi-core trailing cables, are quite difficult enough for anyone outside a cable factory to tackle. Further, such cases support the argument that mining cables should be armoured, because however skilfully a repair of this nature may be performed, the cable is not the same afterwards, the outer coverings are disturbed and the locality of the repair may quite possibly afford an opportunity for the occurrence of another breakdown.

In short, so long as mining conditions are such that cables are liable to concussion, it seems to be the truest

economy, as well as the safest plan, to armour all cables underground, irrespective of the question as to this being compulsory or not.

We do not know how much the question is affected by the class of cable used, but it may be more than a coincidence that the best trailing cables are used in the Scottish coal mines, the district which had in 1912 the greatest freedom from electrical mining accidents.

Armour.

Remarkable Motor Records.

I am pleased to see the test-sheet and curves in your issue of Nov. 14th. All along, in accordance with your original article, which clearly states "120 B H.P. with a range of speed of 230 to 650 R.P.M.," I have considered these machines as 120 B.H.P. at 230 to 650 R.P.M., whereas the tests are for 650 R.P.M. only. This alters the whole outlook, as my criticisms are based on the lower speed, as any variable-speed (shunt control) motor is understood to be capable of doing its full load throughout the range of speed, for a specified time. On the lower speed basis, I think all my contentions hold good. At the motor's lowest speed, on 120 B H.P., the efficiency will be decreased to a figure, the nature of which I have stated; the field and other losses being greater, the heating will be vastly increased, the peripheral speed, and hence radiating capacity, being decreased. The time required to reach final temperature will also obviously be increased.

I now gather the designer waives the question of performance at lower speed. Taken at the higher speed, the figure he cited for losses in his letter of 28th ult. is about 1 per cent. higher than ordinary commercial machines—probably test bed errors will account for this. The original article states as one of the departures from normal design that "flux densities are pressed up to very high values." The saturation curve contradicts this statement, as only at 80 per cent. full field are normal densities reached. I should advise a very careful study and analysis of the test sheet from various points of view. For instance, the field-speed curve shows that at 650 R.P.M. the field is low, and therefore unstable or sensitive, a difference of 10 per cent. excitation showing an increase of 30 revolutions in the speed. Yet, mark, the test sheet shows constant speed with first period, 10 per cent. decrease in excitation. Probably there are test bed errors, as witness column headed "Res. in." Regarding the last letter, I disagree with the remarks on time of final temperature, and referring back to my letter, repeat, that this time depends on energy radiated per time and energy storing capacity of machine. The latter surely depends on volume, disposition of, and specific heat of materials used, and though I quite agree that "a copper machine" "if" badly designed, would be expensive, I do say that to get minimum time constant, it is as Martin Harvey saith "the only way." I agree with the remarks on cost per unit, providing labour is not increased, but observe that no tangible figure is given. I have now got sufficient information to satisfy me as to my contentions, and to show my belief in the following maxims: "Hide not thy light under a bushel," and "If thou hast the light of knowledge, let others light their candles at it." I give below details of a design, contemporary with the designer's, to show that similar results have been, and can be, obtained, without deviating much from the road on which designers have, in my opinion, to travel :—

Output, 80 B.H.P, volts 300, revolutions 600.
Armature diameter 18·5 in., gross length 7¾ in.
Turns in series between brushes, 99½.
Winding, two circuit single.
Commutator segments, 199.
Weight armature strip, 128 lb.
Number of poles, four; air gap, $\frac{3}{32}$ in.
Diameter pole cores, 7¾.
Shunt A.T. per pole, 4,550.
Shunt weight copper per pole, 11 lb.
Series A.T. per pole, 1,000.
Series A.T. per pole, 3 lb.
Four interpoles 2¼ dia., tips 1¾ × 7¾, with ⅛ gap.
Weight interpole copper = 11 lb. per pole.
Commutator 11 in dia. × 5 in. face = 80 lb. copper.
Total weight of machine = 3,000 lb.

Dimensions were well within your figures, and the temperature rise in 10 hours did not reach 75° F. in any part. Commutation was perfect in either direction with brushes neutral. I considered this machine a departure from contemporary practice, but nothing to write home about, although, on second thoughts, I think it would compare very favourably with the efforts of some of our present-day eminent designers. I think if your correspondent will go into this design, he will come to the conclusion that the last paragraph of my first letter is still true. Now, Sir, if we can see the figures for the full-load run on lowest speed, with no-load speed and full-load speed on constant field, figures, I notice, as I anticipated, left out, no doubt thoughtlessly, from published sheet, I shall then be in the position to finally reply, and no longer trespass on your valuable space. By the way, I am keenly disappointed that none of our foremost designers have had any remarks to make on this subject, which should be of interest to them. I can promise your correspondent that when next in London I shall not fail to avail myself of his kind offer.

W. Rae Joss.

Harrogate, *November 17th*, 1913.

Drastic Procedure.

The formation of an Association for obtaining better conditions for assistant engineers is showing up some of our chiefs in their true colours, one of whom has issued orders "that anyone of his staff joining the Association will be dismissed."

This is a case of interfering with the personal liberty of the assistants, and this chief thinks that because he pays his shift engineers about 37s. 6d. a week for 56 hours' work, he is entitled to tell them what they shall do the remaining 112 hours of the week, when they are free to act as they choose.

Now, then, assistant engineers, you know how you stand; your chiefs have bought you body and soul, and you must not even go to a picture show without first getting permission.

'Tis strange, but 'tis true, that the men who control and operate the most useful supply of energy known, have not the energy and pluck to resist the imposition of conditions so bad and unfair that the average casual labourer would refuse to put up with them for one day.

"Fiat justitia, ruat Cœlum."

November 24th, 1913.

Canadian Electrical Trade.

I am glad to avail myself of your invitation to express my views upon this subject, in which I have taken the greatest interest since my first visit to Canada some three and a half years ago. Since that time I must have travelled over 20,000 miles in the country, having crossed from coast to coast five times. I have also lived for several months at a time in some of the principal cities. My experience has been that which one invariably meets with in studying any new subject, the more deeply one goes into it the more impressed one becomes with the knowledge of how little one knows. Certainly our lack of knowledge, on this side, of the existing conditions and future possibilities of Canadian trade is appalling.

I read with the greatest interest the communicated article in your issue of the 31st ult., and Mr. Berry's criticism of it in your issue of the 14th inst. I am bound to say that my own experience endorses that of the writer of the original communication, every word of which I entirely agree with.

We have heard a great deal during the past few months about the iniquities, or supposed iniquities, of the National Board of Fire Underwriters, but so far as I can gather, the criticisms are chiefly based upon the supposition that inasmuch as it is an American organisation, and the various bodies who constitute the Committee are American societies, it stands to reason that their prejudices must be pro-American and anti-British, and that their rules and regulations will be drafted accordingly.

I am not prepared to say whether or not there is any justification for this supposition, but I do suggest that if

any British manufacturers are able to quote concrete cases where they have received unfair treatment at the hands of the National Board of Underwriters, they should publish their experiences. From my own experience, I find it difficult to believe that such strong prejudices do actually exist. I have had the pleasure of visiting the National Underwriters' Laboratory at Chicago, where I was received with the greatest courtesy. I have also submitted for their approval British-made electrical appliances, and have obtained their consent to their use, subject to the modification of certain minor details of construction. The modifications called for were, moreover, perfectly reasonable and entirely consistent with the restrictions enforced in connection with American-made appliances.

I quite agree with Mr. Berry that the N.E. Code is "built up around the specialities of American manufacturers," but—quite apart from any question of prejudice—it would surely be surprising if it were otherwise. Until quite recently, British engineering manufacturers have ignored the Canadian market, whereas U.S.A. manufacturers have for many years nursed and developed that market, with the result that engineering practice in Canada has naturally followed American lines. My own opinion is that the interests of British investors—who, according to Mr. Berry, have provided considerably more than half the funds for Canadian fire insurance—have been far better protected by rules and regulations drafted to cover the actual apparatus in general use than if they had been broadened to include apparatus manufactured in accordance with British practice, which is at present almost unknown in that country.

Mr. Berry is a specialist who, for many years, has devoted his attentions to the perfecting of a particular piece of apparatus. We all know that his efforts have been crowned with success—but, like many successful men, he is inclined to be hypercritical. Upon visiting a new country he naturally devotes his chief attentions to the subject in which he is principally interested. He finds this particular subject has not received the attention at other hands that he has himself devoted to it—that, in fact, the devices generally used have the same defects as similar devices used in this country before he and others showed how they might be improved—and he at once jumps to the conclusion that the electrical practice of the country is bad.

I think, however, that Mr. Berry will confirm my own experience that Canadian engineers are always ready, and eager, to investigate any new principle or piece of apparatus put before them; in fact, I venture to express the opinion that he found them far more willing to give favourable consideration to his proposals than English engineers were inclined to do when he first commenced his campaign in this country.

I cannot agree with him that the life hazard question is neglected in Canada to the extent he would have us believe. I could quote a number of, to my mind, very necessary rules and regulations for the protection of life in Canada that appear never to have been thought of in this country.

Mr. Berry refers to the inconsistency of a code which insists upon an insulating lining for the metal cover of a three-ampere tumbler switch, "and at the same time allows in the factory a switch 100 times larger without any protective cover whatever." True, but the 300-ampere switch in the factory is known to be dangerous and is not handled by "the man in the street," who, as Mr. Berry remarks, should be protected. There are, however, many thousands of innocent looking three-ampere tumbler switches installed in this country in bathrooms or otherwise in close proximity to earthed fittings, the metal covers of which are uninsulated and no precautions are enforced to ensure that a strand of one of the conductors cannot make accidental contact with the metal cover. It only needs the unsuspecting "man in the street" to attempt to use one of these switches in which accidental contact with the cover has been made—when, say, in his bath—for him to receive a most unpleasant, if not actually dangerous, shock.

The danger of the combination of circumstances referred to may be remote—but it undoubtedly exists, and to guard against this danger, or life hazard, the N.E. Code insists that these switches must be constructed in such a way that accidental contact between the live conductor and the metal cover is impossible.

I have no wish to defend the use of the unprotected switch in Canadian factories, but am merely suggesting that our own regulations may not be as perfect as Mr. Berry would have our friends across the water believe them to be.

I entirely endorse the opinion expressed by Messrs. Chiswell & Co., in your issue of the 14th inst., that British manufacturers are making a great mistake in neglecting the opportunities of Western Canada and in being satisfied, apparently, to leave this district to be handled by agents in, say, Montreal. They overlook—or perhaps do not realise—that the distance between Montreal and Winnipeg is about the same as between London and St. Petersburg, and that there are many hundreds of miles of practically unpopulated country between the two districts.

Western Canada, particularly the Middle West or Prairie Provinces, undoubtedly offers in many respects far greater scope for British manufacturers than Eastern Canada, for the reasons Messrs. Chiswell explain.

Engineering developments in Western Canada have received a temporary check during the past few months, owing to the difficulties Western cities are at present experiencing in procuring the capital for carrying out the many very necessary developments that are contemplated.

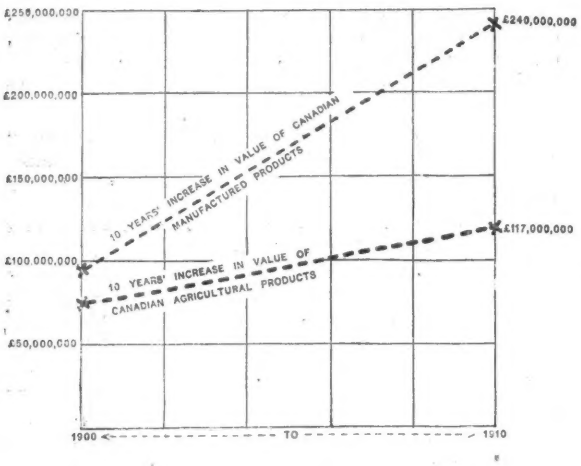
Our City financiers, who guide the British investor—and, in fact, the investor in all parts of the world—tell us that these Western cities have been over-borrowing relatively to their present rateable value, and that they must curtail their expenditure. The position at the moment is a peculiar and difficult one for those who have to contend with it. The average immigration into Canada during the past four years, has been over 1,000 persons per day, and is steadily increasing the whole time. The majority of these new-comers go West, and the flow in that direction is supplemented by numbers of Canadians from the Eastern Provinces. All these people on arriving at the respective cities they are bound for expect to find modern buildings to live in and to work in, an adequate city water supply, modern and efficient sanitary arrangements, electric light and power plants, well-paved and effectively-lighted streets, main line and street railway facilities, &c. For the provision of all these large sums of money are required. It is true that the influx of population brings with it a corresponding influx of capital, but provision for the newcomer must be made considerably in advance of his arrival. The result of the present difficulty in borrowing money to cater for the rapidly-increasing population is bound to mean the temporary adoption of a hand-to-mouth policy of making the best possible provision for the most pressing immediate requirements. This policy must of necessity be economically unsound in the long run, but what alternative has the unfortunate local engineer got but to give the maximum service possible with the funds at his disposal—leaving refinements for the future? He knows that his work will be criticised by engineers from this country—who, when inspecting his work, will doubtless exclaim "how appallingly crude, such practice would not have been permissible under the regulations obtaining in the old country"—but he usually takes all such criticism in good part, probably being an Englishman himself and remembering that when he first arrived, and before he appreciated the difficulties, he was himself inclined to be equally critical.

I have already referred to the misconceptions that exist in the minds of the majority of people in this country respecting the industrial position in Canada at the present time. An example of this is, I think, the idea generally held that Canada is almost a purely agricultural country. I find that if one asks an average Englishman which he supposes to be the greater—the agricultural production or manufactured production of Canada, he invariably replies that the value of the former must be many times the latter. According to Prof. Henry Laureys,* however, the value of the manufactured products of Canada is considerably greater than twice the value of the agricultural production for the same period. What is perhaps even more surprising is the fact that, though the increase in Canada's agricultural production year by year has in itself been phenomenal, the rate of increase

* Pamphlet entitled "Les Industries Manufacturières du Canada," published by Beauchemin, Ltd., 79, St. James Street, Montreal.

in the manufactured production of the country has been even more marked.

The following curves, showing the respective increase in the values of manufactured and agricultural products between the census of 1900 and that of 1910, should convey some idea of the remarkable industrial expansion that is taking place.



The period of industrial development in Canada has been coincident with that of the development of electrical supply, with the natural result that practically every factory in Canada is fully equipped with electric power. In many of the new cities that are springing up all over the prairie provinces, public gas supply is practically non-existent, and new houses are therefore wired for electric supply as a matter of course. It goes without saying, therefore, that there is no other country in the world that offers such attractions for the electrical engineer as Canada—and particularly Western Canada—at the present time.

From my own experiences I am convinced that our many fellow-countrymen and all other British subjects in Canada will cordially welcome any co-operation we on this side are prepared to give them in developing the immense potentialities of this wonderful country—co-operation in dealing with their many new engineering problems, and co-operation in dealing with their financial and commercial problems. They will also accept in good part any criticisms we may have to offer respecting their present methods, so long as the criticisms are combined with co-operation. It is not unnatural, however, that they should resent any tendency to give too much of the former and little or none of the latter.

Leonard Andrews,
Managing Director,
The Canadian British Engineering Co., Ltd.

London, E.C., *November 24th*, 1913.

Mr. Leonard Andrews has, with characteristic courtesy, sent me a proof of a letter which he is addressing to you, in order that I may, if I desire it, meet his criticisms in the same issue of your journal.

I have tried to find where Mr. Andrews differs from my point of view, but I find myself unable to trace it so far, except in matters of detail. On the contrary, I have read his letter most carefully, and I find myself in agreement with him in regard to the broad principle involved.

Like Mr. Andrews, I, myself, visited the Underwriters' Laboratories in Chicago and New York, and I was quite overwhelmed with kindness and consideration. Moreover, the argument in my letter was freely discussed with Mr. Dana Pearce in New York.

I found Mr. Dana Pearce and his colleagues in Chicago most anxious to redress any just grievances of the British electrical manufacturer, and to assist in removing certain obvious anomalies which he admitted existed in the Code.

I wish most emphatically to repeat, and I think my previous letters make it clear, that the honest intentions of the National Board of Fire Underwriters are absolutely above suspicion, but at the same time I am bound to say that I think it will be accepted by British electrical manufacturers as a very graceful act on their part if they will consent to widen the Committee responsible for Rules and Regulations, so that it may include the representatives of accredited British interests.

In making this suggestion, I desire to emphasise the fact that I cast no slur upon the honest purpose of the parties responsible for the existing Code. It is only fair to say that I found that the Underwriters' engineers were not aware, in some instances, of the electrical practice obtaining in Great Britain, but it was a subject which they found full of interest. Is it then surprising that British methods have been overlooked? As I stated in my previous letter, it would be strange were it otherwise.

All I ask on behalf of the British electrical manufacturer, in order that he may build his works and open branches throughout Canada, is that he and his brother Canadian may be given a fair field and no favour.

Mr. Andrews raises the point that I approached this question from the view-point of a specialist in one particular direction. I admit it freely.

My object in starting this discussion is that the views of of all sides may be obtained.

In conclusion, Sir, I would like to add that my remarks in connection with the National Electric Code are directed solely to the application of the rules in the British Dominion of Canada. I have accepted a challenge that under certain conditions I shall erect works inside the Dominion, and I write this letter feeling that on this subject I am already a Canadian.

I again agree with Mr. Andrews. I found the Canadian engineer more hospitable, more friendly and more willing to extend the hand of good fellowship than I have ever experienced before. I look forward with great pleasure to the time when I shall be working with him, side by side.

As the point has been raised, I should like it to be known that my visit to Canada and the United States was in a purely personal capacity. I did not represent any committee, association, or other organisation of which I may be a member.

Herbert H. Berry.

London, E.C., *November 25th*, 1913.

Capping Wood Casing.

We should be pleased to have the opinion of your readers as to whether it is advisable to screw the capping on casings in the centre or at the edges of the capping. In manufacturing these casings and cappings it is our desire to manufacture them to suit the wishes of the electrical trade generally.

When the cappings are nailed or screwed on the outside edges the capping is less likely to gape open and allow dust to get inside the casing; in this case the thicker timber will have to be left on the outside of the grooves, reducing the centre portion somewhat.

On 1½-in. casing what is the best shape, therefore, which will suit the trade?

Any replies from your readers on this point would be appreciated, whether given by sketches or figures.

C. Jennings & Co.

Bristol, *November 22nd*, 1913.

Lead-Tin Alloys.

I am writing to ask if a reader of the Review could tell me the specific resistance of lead-tin alloy—cable sheath material—consisting of 97 per cent. lead and 3 per cent. tin, as usually prescribed for telephone cable sheaths, and the formula for calculating the specific resistance of same alloy with different percentages of lead and tin?

C. A. Smith.

London, W., *November 23rd*, 1913.

[A number of values for this quantity are given in *Tables Annuelles Internationales de Constantes et Données Numériques*, Vol. I.—Eds. Elec. Rev.]

Pressure Regulation.

In my article on this, writing from memory of a description of a Brown-Boveri turbo-generator set, I somewhat hastily wrote that in case of the turbine losing its steam, the field would be wiped out if the current came back through the compound series turns from other sets in parallel. This is not quite correct, as the field would be maintained by other sets in parallel, but at the same time I think it would be so weakened by current in the series turns that the set might run away. The best way to settle the discussion would be for Messrs. Brown, Boveri to explain why they use exciters on C.C. turbo-generators. Perhaps the Editor could get their opinion on the matter.

C. Turnbull.

Tynemouth Electricity Works,
November 18th, 1913.

NEW EL CTRICAL DEVICES, FITTINGS AND PLANT.

2,000-Ampere Armoured Switchgear.

An example of the extent to which the complete armouring of switchgear, designed on the draw-out principle, can be carried is shown in figs. 1 and 2. The views represent one of the sub-station equipments of the Newcastle Electric Supply Co.'s system. There are two panels controlling the 440-volt side of three-phase static transformers, each switch having a current-carrying capacity of 3,000 amperes per phase. The switches are of a strong mechanical design, suitable for use in a situation which is close up to the power station.

Fig. 1 shows the switch withdrawn, with the connections to the bus-bars and current transformers padlocked off, and the oil tank lowered as for the inspection of contacts.

The gear was made by Messrs. Reyrolle, of Hebburn-on-Tyne.

New Cord Grip.

An ingenious and novel type of cord grip was recently brought to our notice by Mr. B. Deakin, M.I.E.E, which ensures the complete separation of the wires as they enter the lampholder, and perfect insulation from the case of the fitting, so that shocks and short-circuits are prevented. The grip can be used with most of the standard holders at present on the market. As shown in fig. 3, it consists of a wooden block A_1 fitting inside the dome of the holder; the flexible leads are threaded through holes at right angles, pass partly round the block in a groove, and again enter holes which guide them into the terminals of the holder. The grip thus obtained is so strong that it is impossible to pull the wires out without breaking them; there is no difficulty in threading them in, or in adjusting the length, and there is no strain on the terminals. The same grip can be used in ceiling roses with advantage, as shown at A in fig. 3.

A useful device to be employed in conjunction with the cord grip is the "Anti-Vibra" earthing shield, which consists of a braided steel sheath enclosing the flexible. The end of the sheath is easily splayed out, and is securely held between the holder and the cord grip; the sheath then takes the whole weight of the lamp and fitting, and protects the flexible from mechanical injury and short circuits. The shield is especially useful in hot climates, where flies do great damage to the flexible, and its resilience renders it an effective protection to metal-filaments against vibration; but its most important function, perhaps, is that of providing an efficient means of earthing the holder and fitting.

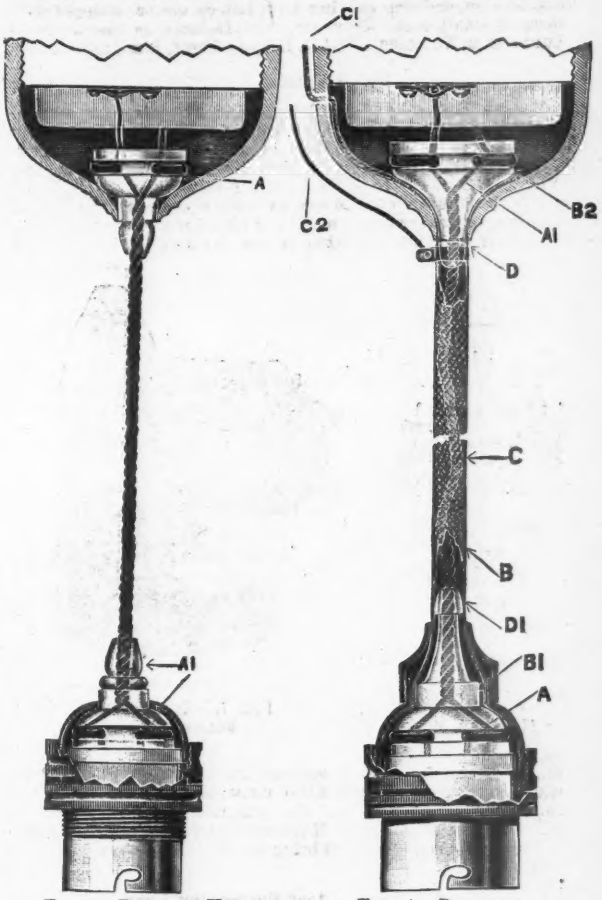


Fig. 3.—Pendant Holder and Ceiling Rose with Deakin Cord-Grips.

Fig. 4.—Pendant fitted with Anti-Vibra Earth Shield.

Fig. 4 shows a complete combination of cord grip in holder and ceiling rose, and anti-vibration shield used for earthing the holder. The separated leads are shown at A and A_1, the shield at B, the cord grips at B_1 B_2, the earthing clip at D, and the earth wire, which is attached after the ceiling rose is closed, at C_2. An alternative method of bringing out the earthing wire through a hole in the cover of the ceiling rose is shown at C_1. Fig. 5 shows a simple plug formed in one piece with the cord grip, and an

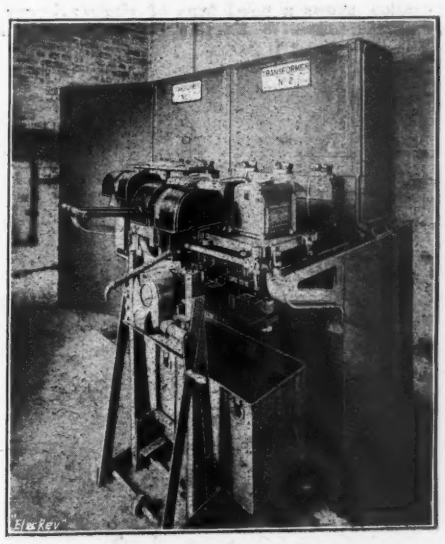


Fig. 1.

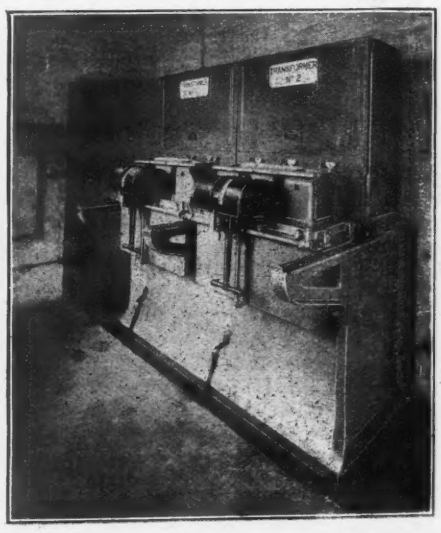


Fig. 2.

Reyrolle Armoured Switchgear.

Fig. 5.—Plug with Cord Grip.

adapter of similar design is made. A wall and earthing plug is also to be had, using the cord grip and shield in conjunction with a three-prong plug. A special feature of the devices is the fact that they are applicable to the standard fittings now in use without modification, and thus existing installations can be equipped with them at small cost. They are manufactured by the Leopold Turners & Workers, 124-127, Leopold Street, Birmingham.

Some Special Motors.

Messrs. Higgs Bros., of Balsall Heath, Birmingham, who are specialising in "fractional" H.P. motors and dynamos, and others in sizes up to about 8 H.P., show in their recent list a neat little hanging motor, fig. 6, which gives ¼ H.P. at 1,750 R.P.M., and is fitted with gun-metal journal and ball-thrust bearings.

The shaft is tapped and can be readily connected to flexible shafting for driving emery wheels, or for other use.

Another compact apparatus is the direct-coupled forge fan,

Fig. 6.—Small Hanging Motor.

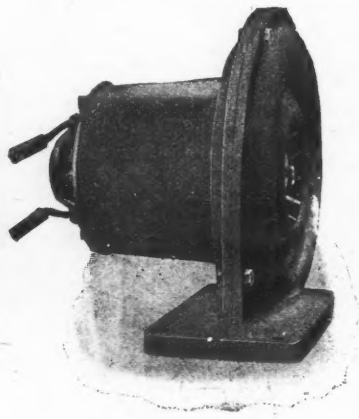


Fig. 7.—Electrical Forge Fan.

shown in fig. 7. This is suitable for 1½ in. tuyers, and 8 in. W.G. draught; the speed is 6,000 R.P.M., and the driving energy required is about 250 watts. The complete device weighs 45 lb. We understand that Messrs Higgs are building motors at the rate of 150 per month, every part being standardised and readily renewable if required.

A Large Contact Suspension Gear.

We illustrate in fig. 8 an eight-ring contact suspension gear, constructed by the London Electric Firm, of Croydon, for suspending an electrolier suitable for seven circuits, from the dome of a church in Edinburgh. It may be noted that the gear is

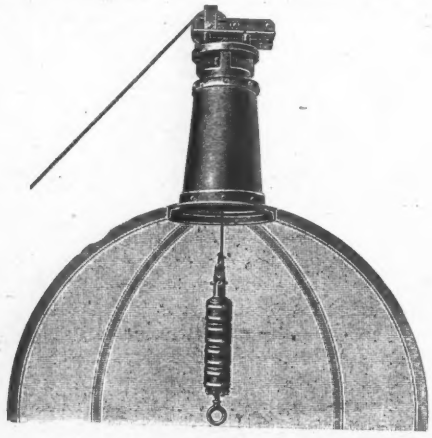


Fig. 8.—Contact Suspension Gear for Electrolier.

supported from beneath, being located between the inner and outer structures of the dome.

A number of four-contact gears have been supplied for picture theatres, giving two separate circuits for red and white lights respectively; also some five-ring gears.

In all cases the weight of the fitting, sometimes amounting to a ton, is only on the winding rope during the actual raising and lowering operations, and, even then, is carried by the firm's self-sustaining winches, which are used in connection with the above gear.

A Telephone Attachment.

A telephone designed by Mr. W. C. Ude, of West Haven, Conn., U.S.A., enables one to call up a person or receive a call without putting his hand to the instrument. This saves much time and confusion in the use of office telephones, where information is often required over the wire and has to be obtained from books, when both hands are needed to handle them; or notes have to be jotted

Fig. 9.—Handy Telephone Attachment.

down, and it is more convenient to have both hands free. The arm carrying the receiver can be turned to either side.

An Electric Boot Warmer.

A novel device for warming and drying boots electrically has recently been placed on the market. This, as shown in fig. 10, consists of two small radiator lamps arranged to be attached inside the fronts of aluminium boot trees and to be coupled up to an

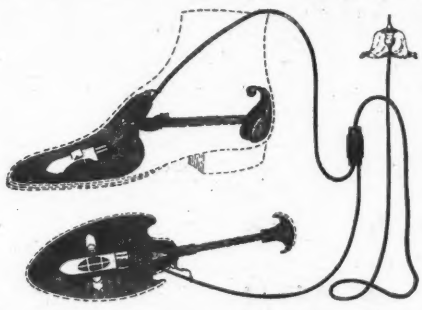


Fig. 10.—Electric Boot Warmer.

ordinary lamp socket. The warming and drying is done more expeditiously from the inside of the boot. One pattern only is supplied, suitable for all voltages.

We understand that the General Electric Co., of Queen Victoria Street, are handling this device.

The Telethermo Heater.

The illustration shows a novel type of electric heater introduced by Messrs. Lester B. Betts & Co., Ltd., of 9, London

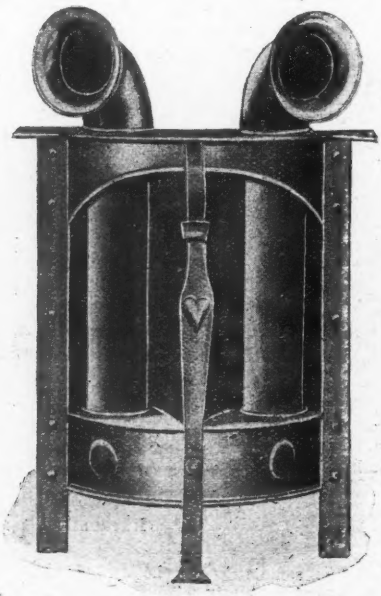


Fig. 11.—"Comfy Corner" Telethermo Heater.

Street, E.C. Its purpose, as the name implies, is to convey heat to a distance, and the method adopted is to direct a current of hot

air in the desired direction by means of two flues with cowls, which deflect the current of air horizontally. The heating elements are fixed inside the perpendicular cylinders of ruby glass which form the main parts of the flues, and are of 250 or 500 watts capacity. The cowls are movable. An 8-C.P. carbon-filament lamp in each ruby glass gives a cheerful red glow to the device.

LEGAL.

Patent Rights of the National Telewriter Co.

In the Chancery Division on Wednesday, November 19th, Mr. Justice Warrington had before him a petition by the National Telewriter Co., Ltd., in the matter of the letters patent granted to Foster Ritchie, No. 24,048, of 1899, for the prolongation of the company's patent rights in an electrical device for transmitting exact facsimiles of handwriting at the moment of writing over long and short distances.

Mr. Walter, K.C., with Mr. Gray, appeared for the petitioners, and the Solicitor-General (Mr. Buckmaster, K.C., M.P.), with Mr. Austen Cartmell, appeared on behalf of the Crown.

Mr. Walter, K.C., in opening the petition, said there was no opposition. The patent did not expire until December 1st next. The Privy Council practice, continued counsel, upon which the extension of patents was based, held that in order to obtain an extension, the invention must be one of considerable merit from the public point of view, and further, that for reasons for which the patentee was not responsible, the remuneration during the period for which the licence was originally granted was not adequate in the opinion of the Court. The invention before his Lordship related to the electric transmission from point to point of writing, drawings, or anything that could be put with a pencil on paper. It was an instrument which could transmit a signature to a bank sufficiently accurately for it to be honoured, along many miles of electric wire. The history of inventors' efforts in this direction showed that in 1858 William Thomson, afterwards Lord Kelvin, made a suggestion along the lines of an apparatus to effect this telewriting, but it did not get any further. He would mention here that Lord Kelvin was a shareholder in the present company, and shares were held by Lady Kelvin at the present time. Lord Kelvin got no further in the direction of telewriting beyond the transmission of certain signals which could be interpreted by light thrown upon a wall, and possibly on photographic material, which afterwards could be developed. Next came Cowper's series of patents beginning in 1878. Cowper had the idea of an electrical device controlling an apparatus at the end remote from where the operator was signalling, and the way in which he accomplished this was by an apparatus which responded, unfortunately, to no particular law, but which undoubtedly did give, within small limits, fairly accurate results. The writing pencils, however, both at the transmitting and receiving end could only move over a limited range, and another drawback was that the paper on which the operator was writing was constantly moving. Nothing came of that invention. Then there appeared the patents of Elisha Gray, whose instrument formed a great advance. Anything that could be written or drawn could be resolved into two movements—a vertical movement and a horizontal movement. The type of receiver which Gray proposed to attach to his machine was capable of doing this. The operator's pen was connected with levers which moved in two directions at right angles to one another, and the movements of these levers caused electrical pulsations to follow one another along to the receiving instrument, reproducing the step-by-step mechanical movement; thus the pen at the receiving end moved in sympathy with the operator's pen. It was found, however, that Gray's patent was defective, inasmuch as when the operator wrote quickly the mechanical part of the instrument failed to correspond with the electrical part, and confusion resulted, this making the instrument practically useless from a commercial point of view. Ritchie's patent, which was the one before his Lordship, also had the device of two rods working at right angles, but no longer controlled by step-by-step impulses but by variations of electric current. To make certain of the chronometer movement, it was also necessary to have resistance acting upon the same law. By working this combination it became possible to write rapidly and to go back to any particular point in the writing for the purpose of erasing errors, crossing "t's" or dotting "i's," &c. Then by a very beautifully worked-out electrical problem, an exact correspondence was obtained between the pen of the operator and the pen of the recording instrument.

The Solicitor-General intervening, said that one of the objections sent in was that there was not sufficient general novelty and merit in the invention to justify an extension of the patent. The Crown, however, did not feel bound to take notice of any objection, and would leave the point entirely in his Lordship's hands.

Mr. Walter, with regard to the financial side of the application, contended that it was through no fault of the patentee that the remuneration he had received was inadequate. As far back as April, 1895, a company called the Telautograph Co., Ltd., was registered with the object of introducing Gray's instrument upon the market. A number of Gray's instruments were made, but they had eventually to be withdrawn, as they proved to be commercially unworkable. By September, 1898, the company had come to the end of its resources, and another company, called the Facsimile Syndicate, Ltd., was registered, of which Sir J. Craggs and members of his family were practically the sole financiers. Mr. Ritchie, who had come over from America to work the Gray instrument, had devoted himself to remedying its defects, and the present invention was the result of his energies. Throughout he had been employed continuously by the various companies which had been formed in connection with the device, and he had received, almost entirely from Sir J. Craggs and his family, a salary of from £400 to £500 a year as manager, making up to date a sum paid to him of about £7,000. The patent was taken over by the Facsimile Co., and further licences arose which led eventually to the development of the National Telewriter Co., Ltd., the present petitioners. Passing on to the actual uses of the telewriter, counsel explained that it was of great use in transmitting coded cables to post offices, and was used by financial houses which would not accept telegrams at all. It was also used in connection with the Liverpool Cotton Exchange for sending out the current prices. A telewriter exchange had been established in Liverpool for this purpose. The instrument had also been established in the Press Gallery of the House of Commons for transmitting news from the Gallery to newspaper offices, and it was used for many other purposes. The need of entering into some arrangement with the Post Office and the National Telephone Co., who were the controllers of wires for sending messages from place to place, was early recognised. Accordingly in 1896 the Telautograph Co., Ltd., entered into an agreement with the National Telephone Co. for the use of their wires, and under it the Telephone Co. charged the Telautograph Co. 27½ per cent. of its gross receipts for the transmission of messages over certain distances, and 22½ per cent. of the gross receipts in respect of others. In April of 1899 the company eventually managed to obtain a licence from the Post Office. It was for one year certain, with six months' notice after that. The charges made by the Postmaster-General were 27½ per cent. of the gross receipts made by telewriters in respect of the use of wires where the rights of the Post Office were non-exclusive; and in cases where the Postmaster-General's rights were exclusive, the charge was 37½ per cent. of the gross receipts. They were the only terms upon which the Telautograph Co. could do business. It meant that the company had to pay out in respect of these agreements 50 and 60 per cent. of the gross receipts, and it became impossible to carry on the business under such terms. Eventually, better terms were secured, and in November, 1904, a new agreement was entered into with the N.T. Co. which provided that where the rental charged by the Telautograph Co. for their instruments exceeded £10, 15 per cent. of the gross receipts should go to the National Telephone Co., and in cases where the rental was under £10, it was to be 10 per cent. of the gross receipts. In consideration, however, of reducing their terms, the National Telephone Co. insisted upon 15 per cent. of the gross rentals from private installations, viz., where the instrument was used from one department to another in big business houses, &c. After long negotiations with the Post Office, in March, 1906, new licences were obtained from the Postmaster-General for a term of five years certain, terminating on six months' notice, at an all-round charge of 10 per cent. on the gross receipts, but no right was granted to use the telephone exchanges, or even to set up exchanges of their own. In 1906 a further agreement was secured with the Post Office on much better terms. A licence for 21 years certain was obtained at 10 per cent. of the gross rentals after deducting any sums paid for telephone line rental. The now well-known clause of the Postmaster-General giving him a right to purchase was also inserted. There was a further clause permitting the use of the telephone as supplemental to the telewriter, and also permission was given to establish special telewriter exchanges, but the company was still forbidden to use them at the telephone exchanges. It lived in hopes, however, of getting that concession eventually. Of course, with such a licence the company, now the National Telewriter Co., were able to do more business, and they had already established two exchanges in London, and a third, which he had already referred to, in Liverpool. The return of the company's receipts had shown an increase from £801 rentals in 1909 to £5,453 during the present year.

Expert evidence was given by Prof. C. V. Boys, who described minutely the mechanism of the patent. He praised in the highest terms the cleverly worked out electrical problem involved in the instrument, and said the precision and accuracy with which it worked were little short of superhuman.

Sir John Craggs gave evidence as to the growth of the various companies concerned and the financial aspect of the matter.

Mr. Foster Ritchie, the patentee, in evidence, said he was an electrical engineer, and chief engineer to the petitioning company. From 1882 to 1896 he was electrical superintendent to the Electrical Manufacturing Co., of Chicago, and as such became associated with Elisha Gray. For several years he worked with him in connection with the telewriter machine. Eventually witness came over to England to work the Gray patents for the Telautograph Co., and he had been employed by that and the subsequent companies ever since. After the failure of the telautograph as a commercial machine, witness set himself to work to perfect the instrument, with the result that the present machine was patented. The power to establish exchanges, witness said, marked a great development in the petitioning company's business. In his opinion, the real business of the company lay in that direction.

In giving judgment, his Lordship said it was obvious that the instrument could be used for a certain quasi-public purpose, as was shown by its use in the Liverpool Cotton Exchange. He held that the want of sufficient remuneration to the patentee up to the present time was not due to anything within the patentee's control, but was largely due to the fact of being unable to get the use of telephone lines. He thought the petitioners should be granted some further time in order to exploit their patent on a profitable

basis. It was not, however, a case where the outside limit of extension should be granted, but he proposed to grant an extension of the patent for five years, and he would make an order to that effect.

Greenwood *v.* Salford Corporation.

On the 21st inst. an action to recover damages for the loss of her husband was brought by Mrs. E. D. Greenwood, of Whit Lane, Pendleton, before Mr. Justice Bailhache and a common jury, at the Manchester Assizes, against the Salford Corporation.

According to Counsel's statement, Greenwood was a hairdresser, aged 37. He had alighted from a tramcar in Frederick Road, Pendleton, about 11 p.m. on June 17th, and was walking towards the footpath, when he was knocked down, run over, and killed, by a motor-tower wagon belonging to the tramways department of the Salford Corporation, which came up at a very fast speed, and without any warning.

The jury awarded the plaintiff £500 damages.

British Westinghouse Electric and Manufacturing Co., Ltd.

In the Chancery Division on Tuesday (25th inst.) Mr. Justice Astbury had before him a petition of the British Westinghouse Electric and Manufacturing Co., Ltd., to confirm a reduction of capital from £1,875,000 to £1,150,000.

Mr. Clauson, K.C., for the company, said it was proposed to write off £725,000, the amount of capital lost or unrepresented by available assets.

His Lordship said he had been through all the facts, and counsel need not trouble with them.

Mr. Clauson stated that the loss was on patents, goodwill, and on account of a very heavy arbitration between the company and the Underground Electric Companies, and other causes.

His Lordship sanctioned the reduction.

Hankow Light and Power Co., Ltd.

Mr. Justice Joyce, in the Chancery Division, on 21st inst., heard a motion by Mr. H. C. Frank, a shareholder, to restrain the company from declaring a dividend on its ordinary shares on a cumulative basis. Plaintiff contended that the ordinary shares only carried a non-cumulative dividend according to the regulations of the company. Later it was stated that the case depended on the construction of the memorandum of association and the effect of a resolution, and whether the shares were in fact issued with the preferential rate.

His Lordship decided to hear the motion on Tuesday.

Workman's Compensation Claim.

At Rotherham County Court last Friday, George W. Howard, electric welder, applied for compensation, the respondents being Messrs. Edgar Allen & Co., Ltd. Applicant alleged that he had lost the sight of his right eye in the course of his employment. Dr. Walker, of Leeds, sat as medical assessor.

According to the report in the *Sheffield Daily Telegraph*, Mr. Howe stated that Howard was doing his work as an electric welder, on May 19th, 1913, when there was a flash in his face. The sight of the right eye was practically lost, but the left eye was about normal. The applicant's wages at the time were over £2, and £1 a week compensation was paid up to July 1st. The respondents denied total incapacity. The real point seemed to be whether the present condition of the right eye was in any way attributable to the flash, or whether it was entirely due to previous disease, or some other cause.

His Honour (Judge Benson) acting on the opinion of the medical referee, gave judgment for the respondents.

Giant Finance Co., Ltd., *v.* Victoria Falls and Transvaal Power Co., Ltd.

Before Mr. Justice Pickford in the King's Bench Division on 20th inst., plaintiffs asked for a declaration that, as assignees of Mr. M. F. Armstrong, they were entitled to a commission on the gross actual receipts in respect of electric power supplied to the Eckstein group of mines on the Witwatersrand and other undertakings. The defendants denied that Mr. Armstrong obtained any contract for the supply of electric power to the Eckstein group, or that they supplied the group. They said that a contract to supply the group was obtained by a Mr. Harper, that a subsidiary company—the Rand Mines Power Co.—was formed to take over the business, and that Mr. Harper was paid £70,000 for his rights. The hearing of the case was continued on 20th inst., when his Lordship deferred judgment.

Factory Acts Prosecution.

At the Birmingham Police Court, on 20th inst., Messrs. William Bayliss, Ltd., tube manufacturers, Wiggin Street, were summoned under the Factories and Workshops Act with neglecting efficiently to earth metal work and a portable lamp, in consequence of which neglect a workman named George Farraday suffered bodily injury. The defendants were also summoned for neglecting to provide efficient means suitably located and capable of cutting off and controlling electrical pressure.

According to the report of the case in the *Birmingham Mail*, Mr. J. E. Harston, Inspector of Factories, appeared in support of the summons.

William Lee, a workman employed by the defendants, said that on October 8th last Farraday was found in an unconscious condition. The witness attempted to raise him from the ground where he lay, and received a shock. Lee had to release his hold of him. Another employé named Dolby declared that the voltage was 110. When he saw Faraday lying prostrate on the floor he cut off the current. A copy of the Electrical Regulations was fixed up in the premises, and if they had been infringed they had been infringed through being misconstrued. Mr. Evans, a representative of the defendant firm, questioned the witness with regard to the electrical installation. The witness said that electrical experts had seen the apparatus, and only 14 days before the accident it was tested by them. Dr. Sampson, of the General Hospital, said that when the man Faraday was admitted to the institution he was in a very critical condition. The witness had never seen such a severe case of electric shock before.

The defendants pleaded guilty. Mr. Evans declared that they had been "let down" by the electrical experts. They were deeply grieved at the accident.

The Bench considered the case a very serious one. The defendants were fined £50, with £3 19s. 6d. costs on the first summons, and £5 and 10s. 6d. costs in the second case.

BUSINESS NOTES.

Catalogues and Lists.—Messrs. J. H. Holmes & Co., Newcastle-on-Tyne.—Pamphlet No. 91 containing illustrations and brief particulars of "Universal" electric light fittings; also a pamphlet relating to their electric controlling apparatus for printers, a lengthy list of printing offices equipped by the firm being given.

The Westinghouse Brake Co., Ltd., 82, York Road, King's Cross, London, N.—Pamphlet describing the Westinghouse steam heating apparatus for steamships.

The Westinghouse Cooper Hewitt Co., Ltd., 80, York Road, King's Cross, London, N.—12-page pamphlet, entitled "That Blue Light," concerning the application of mercury vapour lamps to box advertising signs and the illumination of buildings. Pictures are included of buildings lighted by this means, and of the different types of lamps and fittings used.

The Sterling Telephone and Electric Co., Ltd., 210 and 212, Tottenham Court Road, London, W.—Several publications. No. 173 (8 pages) gives illustrations, with revised prices, &c., of "Primax" automatic interphones; No. 179 deals with electric bells; No. 210 gives prices of receivers for wireless telegraphy; and another contains illustrations and prices of condensers for telegraph, telephone, ignition, and other service.

Messrs. C. Jennings & Co., Pennywell Road, Bristol.—266-page bound catalogue containing fully illustrated information and prices of their numerous manufactures in woodwork, ranging alphabetically from arches to woodwork mantelpieces. Particulars are included relating to their electric light casings and cappings, also creosoted troughing for underground cables. The makers of this troughing claim that whether it is creosoted by dipping or by pressure the material used is free from acids injurious to the lead or other coverings on the cables. Sharp flexion and fatigue are avoided owing to the longer lengths and elasticity obtainable with a wood trough system. A large stock of teak for the electrical trade is listed. We have also received one of the firm's fourfold brass jointed rules.

Messrs. Higgs Bros., Dynamo Works, Sherbourne Road, Balsall Heath, Birmingham.—Ten-page illustrated pamphlet in binding cover, containing specification of small motors for propeller fans, forge fans, and electric drills. Shunt and series motors, enclosed ventilated, from ⅛ to 7½ h.p., and shunt generators from ·2 to 4 kw., are particularised as to speeds, prices and dimensions, and information is given of controlling gear.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C.—The *Mazda House News* for November contains in its 20 pages a good deal of chatty and interesting information relating to "Mazda" lamps, fittings and lighting, and publicity literature concerning same.

Messrs. Drake & Gorham, Ltd., 1, Felix Street, Westminster Bridge Road, London, S.E.—The firm's 1914 catalogue is a very bulky one. It consists of 13 sections separated by a thumb index, and with a complete alphabetical index for the whole of the contents. As usual the book is profusely illustrated, and prices are clearly indicated. The manufactures of which particulars are given include all makes of metal-filament and other incandescent lamps, arc lamps for various purposes, cables and flexibles, switchboards, switchgear, measuring and testing instruments, electric lighting accessories, electric radiators, fires, heaters, cooking and heating appliances, telephones for different classes of service, motors, starters, fans, vacuum cleaners, prepayment devices, Holophane and other glassware. The last and largest section is that dealing with electric light fittings, indirect and semi-indirect lighting, fittings, Striplite, watertight fittings, &c.

The A.E.G. Electrical Co. of South Africa, Ltd., Caxton House, Westminster.—Pamphlets describing the A.E.G.-Nitra lamps, of 600-3,000 c.p., taking ½-watt per candle, with fittings and accessories.

Patent Notices.—An order has been made restoring letters patent No. 25,736 of 1908, granted to Edward Temple, for "Improvements in and relating to washing or purifying apparatus for use in gas generating plants."

An application has been made by H. Hartley and V. Canova for restoration of patent No. 13,359 of 1908, for "Improvements in taximeters or the like indicating and recording instruments."

Glasgow Exhibition Electric Kitchen.—The accompanying photograph illustrates a series of Carron cooking appliances which were used in the restaurant kitchen at the Glasgow Electrical Exhibition by Mr. James Craig, of Glasgow, the caterer for the Exhibition. The appliances consist chiefly of

Carron Electric Kitchen at Glasgow Exhibition.

an 18 in. × 15 in. grill and hot-plate; a breakfast cooker set, consisting of a 10-in. grill with an 8-in. boiling plate; a 24 in. × 18 in. baking plate; a 4 ft. × 2 ft. 6 in. hot closet and carving table; three-gallon water boiler, and one of the company's standard electric cookers, No. 860. These appliances were found sufficient to provide luncheons, teas and other refreshments for a daily average of 500 people, and were worked at high pressure throughout the run of the Exhibition. The results obtained were highly appreciated by the public, as well as by the caterer, Mr. Craig, and the Exhibition management generally.

Private Arrangements.—Accessories Manufacturing Co., Ltd., 11, Dean Street, Oxford Street, London, W., electric accessories manufacturers.—Pursuant to the provisions of the Companies' (Consolidation) Act, a meeting of the creditors of the above was held on Friday, November 14th, at the offices of Messrs. Roberts, Wright, McCann & Co., chartered accountants, Pancras Lane, E.C. It was reported that the shareholders had passed resolutions in favour of voluntary liquidation, and had appointed Mr. H. A. McCann to act as liquidator. A statement of affairs was presented showing the position as at October 29th last, and this disclosed liabilities of £1,386, all of which were due to unsecured creditors. The assets were estimated to realise £1,368, less £141 for preferential claims, leaving net assets of £1,228, and a small deficiency was thus disclosed. The assets consisted of cash in hand and at bank, £20; sundry debtors £466, expected to produce £350; stock-in-trade at or under cost prices, £899; and fixtures and fittings valued at £100. It was reported that the company was registered on November 7th, 1910, with a nominal capital of £5,000 in £1 shares. There were 4,900 preference shares, and 100 ordinary shares, all of the face value of £1 each. The company was formed to take over the assets of a previous company. The purchase price payable for the assets was agreed at £1,670, and that amount was discharged by a payment in cash. During the first 12 months that the company was in existence it carried on business at a loss of £200, while in the succeeding year there was a further loss of £400. After discussing the position the creditors decided to confirm the voluntary liquidation of the company, and approved the appointment of Mr. McCann as liquidator. A committee of three of the principal creditors was also appointed to act with the liquidator.

Electrical Co., Ltd.	£202	Ickelheimer, Max.	£46
Gilson & Co., Ltd.	194	Macintyre & Co., Ltd.	47
Goossens, Pope & Co., Ltd.	20	Outram & Co.	42
Heath & Co., Ltd.	384	Zimmerman & Co.	32
Hawkins Bros.	27		

Telephone Rents.—On Tuesday an action was brought by the Postmaster-General, in the Manchester County Court, to recover one year's rent of a telephone, due in advance on May 9th, 1912, from J. Solberg, partner in the late firm of Kirby & Solberg, of Harpurhey. Notice of dissolution of partnership was published in the *London Gazette*, but Judge Mellor held that this was not sufficient, and the defendant was liable. At the same time, he expressed astonishment that the Government should press the claim, as the defendant had only had nine months' use of the telephone, and was being made to pay for two years' use.

Book Notices.—*Applied Mechanics.* By A. Jamieson. Vol. V. London: Chas. Griffin & Co. Price 7s. 6d.—This, the eighth edition, incorporates the author's last additions and alterations; it treats of the theory of machines and practical mechanisms, and follows the syllabus of the final B.Sc. examination in engineering for external students of the University of London, covering also that of the Institution of Civil Engineers for the Associate Membership examination. The work is so well known that we need only commend it to new readers as one of the most lucid and instructive text-books extant on this subject, written in the author's inimitable style, and fully illustrated. Numerous examples and examination questions are included.

We have received a copy of the first number of the *International Review of Commerce and Industry*, a monthly magazine, edited by Mr. T. Swinborne Sheldrake. The price is 2s. net, and the intentions of the publishers (Messrs. L. Upcott Gill & Son, Ltd.) are to produce a high-class review dealing with international commerce and industry in the same way that the well-known monthly reviews cover politics, literature, social and religious questions. The opening pages contain, under the heading "Markets of the World," a collection of useful notes on commercial conditions, which are well informed, and cannot fail to be of service to all who wish to follow the course of matters bearing upon trade and commerce in different parts of the world. These comments are followed by a number of articles from the pens of authorities, on a variety of matters coming within the scope of such a publication. Among the articles in the present issue (December) are the following:—Commerce and the Universities, Trade Routes as they will be Affected by the Panama Canal, Oil Fuel and its Use for Steam Raising, The Incidence and Effects of the New American Tariff, The Commercial Outlook in China, The Merchant System and Oversea Trade, A Retrospect and Prospect, by the editor, Siberia of To-day, extracts from official reports and from the world's commercial Press. We extend to our new contemporary the hand of welcome, and wish the editor every success in his efforts to maintain that high standard which is his aim, and to which he fully attains in his first issue.

"Insulation and Design of Electrical Windings." By A. P. M. Fleming and R. Johnson. 1913. London: Longmans, Green and Co. Price 7s. 6d. net.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXX, Part 1. November, 1913. Newcastle-on-Tyne: The Institution. Price 5s.

"The Influence of Inert Gases on Inflammable Gaseous Mixtures," by A. Clement. "Monthly Statement of Coal-Mine Fatalities in the United States, July, 1913," by A. H. Fay. "A Laboratory Study of the Inflammability of Coal Dust," by J. C. W. Fraser, E. J. Hoffman and L. A. Scholl; and other mining pamphlets. Washington: Government Printing Office.

"*Journal* of the American Institute of Architects." October, 1913. Washington: The Institute.

"The Physical Review." Vol. II, No. 5. November, 1913. Lancaster, Pa. The American Physical Society.

"*Journal* of the Western Society of Engineers." Vol. XVIII, No. 7. September, 1913. Chicago: The Society. Price 50 cents.

"Memoirs of the College of Science and Engineering, Kyoto Imperial University. Vol. 5, Nos. 6 and 7. May and August 1913. Kyoto: The College.

"*Journal* of the Franklin Institute." Vol. CLXXVI, No. 5. November, 1913. Philadelphia: The Institute. Price 50 cents.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, No. 21. November 15th, 1913. Milan: Stucchi Ceretti & C. Price Lire 1.50.

"*Boletin* de la Sociedad de Fomento Fabril. Vol. XXX, No. 10. October, 1913. Santiago de Chile: The Society.

Condensing Plant Contracts.—Orders for condensing plant have recently been received by the Mirrlees, Watson Co., Ltd., for:—The City and Guilds (Engineering) College; the Carron Co.; De Beers Consolidated Mines, Ltd. (Kimberley); New Jagersfontein Mining and Exploration Co., Ltd.; Fife Power Co.; Bournemouth and Poole Electric Supply Co.; Oldham Corporation; and a number of collieries.

For Sale.—Reading Corporation has for disposal a steam engine and fan, also a fan suitable for direct electric drive. Particulars are given in our advertisement pages.

The Norwich Electric Tramways Co. is offering a 200-kw. Westinghouse dynamo and Browett-Lindley engine for sale.

Bankruptcy Proceedings.—William Henry Davis (lately trading as the General Incandescent Fittings Co.), dealer in gas and electric light accessories, 75, Ralph Road, Saltley, Birmingham.—The first meeting of creditors herein was held last week at 191, Corporation Street, Birmingham, when the statement of affairs showed liabilities amounting to £227, and assets estimated at £44 odd, the estate disclosing a deficiency of £182. The debtor started trading in 1898 as a dealer in gas and electric light accessories, having at the time no capital. He had had no experience of the trade, but was fairly successful until 1909. Debtor had for several years had the regular custom of a brewery company for the supply

of accessories to their licensed houses, but owing to the loss of that business and to illness, he became financially embarrassed, and on September 9th accepted a situation which was offered by one of his creditors. The debtor was indebted to his daughter to the extent of £60 for arrears of wages on June 22nd last, and he paid her £20 on account, which sum was immediately repaid to the debtor in purchase of household furniture. The books of account kept consisted of a sales ledger and a day book, and debtor had not at any time endeavoured to ascertain his financial position. The matter was left with the Official Receiver.

J. G. M. Hilton, electrical engineer, Birmingham.—The application to approve the scheme of arrangement was refused, and the debtor adjudged bankrupt, at Birmingham, on November 19th.

Wakelin Bros, 9, Tottenham Street, W.C.—December 10th is the last day for the receipt of proofs for dividend by the liquidator, Mr. W. A. Henderson, 3, Fenchurch Street, London, E.C.

Dissolutions and Liquidations.—Safety Light, Ltd., 118, Queen Victoria Street, London, E.C.—Messrs. P. J. Goodchild & Williams have been appointed joint receivers for the debenture-holders. Pending the preparation of accounts of the position of affairs they are continuing the business as a going concern.

Clampett & Duckworth, electric light and power engineers, 5, Cathedral Yard, Manchester.—Messrs. R. H. Clampett & J. Duckworth have dissolved partnership from November 15th. Mr. Clampett attends to debts, &c., and he will continue the business as Robert H. Clampett & Co.

Lund Bros. & Co., electrical and mechanical engineers, 78-80, Queen Victoria Street, London, E.C.—Messrs. R. Lund & F. C. Polden dissolved partnership as from June 30th, 1911. Mr. Lund will attend to debts and continue the business under the same style at the same address, and Mr. Polden will carry on business under the style of F. Polden & Co., at 56, Cannon Street, E.C.

Trade Announcement.—Mr. S. Ferguson has resigned his position as chief draughtsman to Messrs. Ferranti, Ltd., and is joining Mr. G. Pailin for the purpose of carrying on the business of switchboard building. The new firm is entitled Messrs. Ferguson, Pailin & Co., Edward Street, Higher Openshaw, Manchester, and it is not connected with Messrs. Ferranti, Ltd.

Lamp Works Extensions.—We understand that extensions are now in progress at the works of Pope's Electric Lamp Co., Ltd., at Willesden, which, when completed, will enable them to cope successfully with their largely increased business in "Pope Elasta" wire lamps.

Germany.—A company has recently been formed in Stettin, with the title Die Pommersche Gluhlampenerneuerung Gesellschaft, to exploit a process for the renewal of burnt-out lamps.

France.—A company has lately been formed at Lyons, with a capital of £40,000, and the title La Société pour l'Electro-Métallurgie du Zinc, to exploit a new process, known as the Côte and Pierron, for the electrical production of zinc, which was described in our issue of September 12th, 1913.

LIGHTING and POWER NOTES.

Abercarn (Mon.).—Prov. Order.—Powers for E.L. within the area of the U.D.C. are being applied for by the South Wales E.P.D. Co.

Accrington.—Another extension of the Corporation electricity works, involving a large capital outlay, is in contemplation in order to meet the ever-increasing demands for current from both inside and outside the borough. Alderman Higham, the chairman of the department, is a most enthusiastic advocate of electrical methods, and his ambition is to place Accrington amongst the leading municipal electricity undertakings of the country in the matter of cheapness and efficiency. The neighbouring district, Great Harwood, is at the present time negotiating with Accrington for supplies of current. Blackburn is also being asked to quote terms to Great Harwood, and it is stated that before long Rishton will seek an electrical supply from either Accrington or Blackburn.

Argentina.—The Municipality of San Justo (Santa Fé) has accepted the tender of Mr. Carlos Droz for the erection of an electric light station. The contract has been forwarded to the Government for approval.

Sr. P. Ferreira, concessionaire for electric light works at La Plata, has informed the authorities that he has obtained the necessary capital and is prepared to carry out the contract. He, therefore, desires to withdraw his previous petition in which he relinquished the concession.—*Review of the River Plate.*

Aylesbury. — Loan Application.— The U.D.C. has decided to apply to the L.G.B., for sanction to a loan of £20,800 to carry out the E.L. scheme, the sum including £5,425 for plant, £9,852 for cables, and £1,471 for public lighting by the conversion of 265 gas lamps to electric lighting.

Beeston.—Prov. Order.—The U.D.C. has decided not to proceed with the application for a prov. order for electric supply The Notts. and Derbyshire Electrical Co. has already given notice of application for an order to supply electricity in the town

Bingley.—In connection with the supply of electricity which will be commenced in January, 1914, the following scale of charges for lighting has been compiled by the D.C.: 4½d. per unit up to 250 units, 4d. per unit from 250 to 1,000 units, and 3½d. per unit from 1,000 to 5,000 units, with a minimum of £2 per annum. It is proposed to have a separate scale for power consumers.

Canada.—The Department of Agriculture has issued a 50-year permit to the Skagit Power Co. (Bellingham, Ont.), which is a subsidiary of the Stone and Webster Co. The company will construct a power plant in the Upper Skagit River country, to cost $5,000,000, and to develop 27,610 H.P.

Among eight by-laws to be brought before the ratepayers of Winnipeg is one to provide $1,000,000 for power distribution.—*Canadian Engineer.*

Chiswick.— Proposed E.L. Purchase.—The U.D.C. on the 19th inst., discussed the proposal to promote a Bill for taking over the undertaking of the Chiswick Electricity Supply Corporation. Councillor C. E. Bovill said that the prov. order was now vested in the electricity undertaking, but under the terms of the agreement the Council had an opportunity in January next of acquiring that undertaking at a figure that fairly represented the actual money expended, and as represented the works, without any price for goodwill. The Council had taken the advice of Mr. Snell. After making allowance for depreciation and replacement of engine power, he believed the Council would in the future make a very considerable profit. Ald. Helmsley severely criticised the proposal, the report, to his mind, being in the nature of the prospectus of a limited company inviting ratepayers to become shareholders, and he considered it would be a calamity for the district to buy it. Councillor Stone, after eliciting from the chairman that a town's meeting would be necessary before the Council could promote the Bill, said that certain representatives of the Council had had an interview with the Brentford Gas Co., and some sort of an arrangement had been made for the latter to take over the undertaking on certain conditions. After other members had opposed the motion on the ground that they objected to municipal trading, the debate was adjourned, but we understand that at the subsequent meeting a resolution to proceed with the Bill was carried.

Continental Notes. — France. — The French State Railway authorities have decided on the establishment of a large electric generating station at Rouen for the electric lighting of the various railway stations in that city and for lighting power puposes at the extensive railway works at Sotteville, just outside Rouen.

The much-discussed scheme to harness the Rhone at Pougny-Chancy, which is of much importance industrially to the future of the Gex country, has advanced a stage with the announcement of the Minister for Foreign Affairs that a Franco-Swiss convention was signed on October 1st, regulating the division of the water-powers of the Rhone. The scheme, at the head of which is M. Crépel, Deputy for Gex, may now be expected to be realised at no distant date.

The Société des Forces Matrices de la Cère, says the *Revue Pratique de l'Electricité*, has under consideration a scheme for the establishment of a big hydroelectric generating station and factory for the manufacture of nitrate of soda. The plans propose the construction of a dam across the bed of the Cère, and the conveyance of the collected water a distance of 30 km. in tunnel, giving a head of 160 metres. The cost of the undertaking is estimated at £800,000. The land has already been acquired, and operations will be begun forthwith.

Switzerland.—The Swiss Government has lately granted a concession for the establishment of a large plant to utilise the water-power of the Rhine at Eglisiau, in the generation of electrical energy. The full capacity of the plant will be 24,000 H.P., but this, it is estimated, will only be available on 80 days per year, the capacity, owing to the fall of the level of the river dropping at low water to 12,500 H.P. Four turbines and generators of from 3,400 to 4,000 H.P. are to be installed, the total cost of the installation being estimated at £528,000.

Germany.—The Westfalen Elektricitäts Gesellschaft, which has a large electricity supply station at Hattingen, proposes to establish two additional plants—one at Hamm and one at Haltern, with the view of supplying current for lighting and power purposes in the eastern and northern districts of Westphalia. It is expected that by the end of next year the company will be supplying current to no less than 100 towns and villages.

Norway.—A company with a capital of about £35,600 has recently been formed with the object of generating electric power from the numerous waterfalls in the neighbourhood of Sandefjord, about 65 miles south of Bergen. According to the local Press, the total power produced will be from 70,000 H.P. to 80,000 H.P. Two power stations will be erected and very extensive damming operations are to be carried out. A water-tunnel 8·5 km. (about 5¼ miles) long is also to be constructed.—*Board of Trade Journal.*

The town of Horten has recently installed electric light. Energy is supplied from a plant at the Skolbenberg Waterfalls, from which H.T. current is transmitted to a transformer station in the town.

Cowbridge and Penybont.—Prov. Order. — The South Wales E.P.D. Co. is applying for a prov. order for E.L. within the borough of Cowbridge, the six parishes in the area of the Penybont R.D.C., 26 parishes in the area of the Cowbridge R.D.C., and in a portion of the parish of Llantrisant.

Deal and Walmer.—Prov. Order.—The Gas Co. is applying for powers to supply electricity in the boroughs of Sandwich and Deal, the urban area of Walmer, and the rural parishes of Ripple, Sholden, Great Mongeham, Ringwould and Word, and the transfer to the company of the undertaking authorised by the order obtained by the Sandwich, Deal and Walmer Electricity Supply Co., Ltd.

Dundee.—New Plant, &c.—On November 18th the Electricity Committee adopted a proposal by the engineer that additional plant to generate 5,000 kw. be ordered for the Carolina Port station

The borough electrical engineer has reported that the standardisation of the electricity supply systems of Dundee and Broughty Ferry—recently annexed to the city—is highly desirable. The lighting pressure in Broughty Ferry is 230 volts, and in Dundee 200 volts. The change has been approved of by the Electricity Committee, and consumers will be provided with new apparatus, where necessary to effect the change. The cost will be between £800 and £1,000.

Earlestown and Newton.—Prov. Order. — The U.D.C. has decided to apply to the B. of T. for a prov. order authorising it to supply electricity.

Easington.—Workhouse Lighting.—The B. of G. has decided to ascertain at what cost electricity can be obtained for lighting the workhouse premises, with a view to the E.L. being installed at an early date.

Edinburgh.—Prov. Order.—The T.C. has had under consideration a letter from the Colinton Tramway Co. intimating that it intended making application for a prov. order to enable it to supply electricity within the parish of Colinton and part of the parish of Corstorphine. The T.C. has now adopted the recommendation of the Electric Lighting Committee, mentioned in our last issue, to make immediate application for a prov. order to extend its own area of supply, so as to include therein the following parishes in the county of Midlothian, viz.: Cramond, Corstorphine, Colinton, Liberton and Newton.

East Ham.—Electricity Assessments.—The borough treasurer reports having interviewed the valuer to the Assessment Committee of the West Ham Guardians with reference to the Corporation's objection against the valuation list in respect of the revised assessments of the electricity and tramways undertakings, which show a net increase in the gross estimated rental of the electricity undertaking of £3,730; of £4,150 as regards the tramways department and increases in rateable value of £2,758 and £3,150 respectively. The revised assessment was £9,450, £15,150, £5,010 and £6,650 respectively. The borough treasurer's suggested revised figures are: Gross estimated rental, electricity undertaking, £8 982; tramways undertaking, £15,899; rateable value, £4,061 and £3,660. At the interview it was pointed out that there were several differences between the valuer and the borough treasurer as to the method of calculating various items prior to arriving at the rateable value, and these are to be the subject of a further interview. The Committee has decided to continue the negotiations.

Haslingden. — The Electric Loom. — During an address to a number of cotton manufacturers, managers and workers, Mr. J. W. Crowley, a well-known expert on electrical power in its application to the textile trades, was asked what chances there might be of an electrical loom in the future.—Mr. R. Cotton, who put the question, said there were jacquards in which the thread was selected electrically. An electrical loom might tend to less complications in fancy weaving.—Mr. Crowley, in replying, said he was afraid that development in this direction was some distance off. There was, however, a big opening for anyone who could devise a better machine than the present loom, which was anything but good mechanism.

Hawarden.—Prov. Order.—The R.D.C. intends to apply for a prov. order to supply electricity within the parishes of Hawarden and West Saltney.

Hereford.—Loan Sanction.—The T.C. has received sanction from the L.G.B. to a loan for £1,000 for services, and for £33, the excess expenditure on mechanical stokers at the electricity works.

Hertford.—E.L. Agreement.—The T.C., after much negotiation, and after a B. of T. inquiry on the appeal of the North Metropolitan Electric Power Supply Co., which contended that the Council had unreasonably withheld consent for it to supply current for power within the borough, has sealed an agreement between the company and the North Metropolitan Electrical Power Distribution Co., which holds the Council's E.L. order under transfer. The Power Co. has laid a trunk main through the borough for the purpose of affording a supply of alternating current at high voltage beyond the area of supply of the Corporation, and under the agreement the company will be enabled to supply current off the main to the Distribution Co. for use in the borough, and the latter company will supply all the necessary sub-stations, machinery, plant, switchgear, distributing mains and other apparatus, which will become purchaseable by the Council should it at any time desire to execute its power of purchase, in which instance the Council would take current from the Power Co. for not less than seven years on terms to be agreed upon.

Higham Ferrers.—The B. of T. has informed the T.C. that the undertakers of the Rushden and District E.L. order, who had deposited £400, had applied for £300 to be returned, and as work to that amount had been carried out, it was proposed to grant the request.

Hove.—The Corporation has now almost agreed on the amount of the purchase money to be paid to the Hove Electric Lighting Co., Ltd., for taking over its undertaking, which will probably be about £200,000. We understand that the Corporation is accordingly now prepared to receive propositions from responsible persons for leasing the undertaking, together with the undertaking in Aldrington, which has from the first been run by the Council itself. The company has for some years past paid large dividends and built up a large reserve fund, and it is believed that the undertaking would, in the hands of the right parties, form an attractive investment. Particulars can be obtained from the Town Clerk, Hove Town Hall.

Llandiloes. — Prov. Order. — The T.C. has been informed that the Llandiloes Electric Lighting Co., which is now being formed, intends to apply for a prov. order to supply electricity within the borough, and a Committee has been formed to consider the question of supporting the company.

Llanfairfechan. — E.L. Scheme. — The U.D.C. has appointed a Committee to open negotiations with the North Wales Electric Power Co., for a supply of electricity. The engineer engaged by the Council estimated the capital cost at £3,250, whereas a local water-power scheme would cost £5,250. The Power Co.'s terms, on the basis of 24,000 units, were a lease of seven years and a charge of £120 per annum for the first two years and £150 per annum for the remaining five years—equal to a charge of 5½d. to 6d. per unit to consumers.

London.—St. Pancras.—The Electricity Committee has received a letter from the Comptroller of the L.C.C. in connection with the Council's application for sanction to the borrowing of £15,000 for the 5,000-kw. Ljungstrom turbine set for the King's Road station, asking to be advised more fully in respect to the contemplated extension, as it was desired to consider more closely the possibility of the B.C. obtaining a bulk supply as an alternative to the proposed extension of the undertaking, and in order that the financial aspect of the matter may be more clearly understood, he was requested to ask for full particulars received by the B.C. as to a supply in bulk, and for detailed figures showing how the opinion that it would be more economical for it to extend its own plant was arrived at, and what was the amount of saving anticipated by the new plant contemplated. The chief electrical engineer reports that the capital expenditure required would amount to £66,018. This amount included £15,000 for the turbine under discussion, and made provision in the boiler house for further extensions of boiler plant at a later date. The saving anticipated by the installation of the proposed new plant, on the assumption that electricity could be purchased in bulk at £4 per kw. and ·33d. per unit (which was the offer obtained for supply in June, 1912), and after allowing for the L.C.C.'s shortened periods for repayment of loans, is estimated at £21,417. Since the offer for supplying in bulk referred to above was received, a lower price of £3 per kw. and ·25d. per unit has been offered to a neighbouring borough, and on the assumption that electricity could be purchased at this lower price, the installation of the anticipated new plant would, it is estimated, still show a saving of £9,584. These facts, and the point that if a bulk supply was obtained it would not offer the reliability and certainty of service which is obtained by the Council with the control of its own generating plant, are to be forwarded to the L.C.C.

The L.C.C. has sanctioned the following loans by the St. Marylebone B.C.:—£10,825 for electricity purposes, £4,300 for mains, £1,325 for auxiliary plant, and £5,200 for house services; also a loan of £5,000 for the purposes of the Fulham electricity undertaking.

The Finance Committee has recommended the L.C.C. to sanction the borrowing by the Stepney B.C. of £7,180 for the purchase of property in connection with the electricity undertaking.

At the Tuesday's meeting of the L.C.C., the chairman of the London Electricity Supply Committee was asked whether he could give any information regarding the proposal of the County of London E.S. Co. to apply for powers to postpone the date of purchase of the London Companies by the Council, and in reply, he said that nothing could be usefully done until the Bill was produced. He had heard, however, that the idea was to form a "super-company" to acquire all the present companies and to offer local authorities bulk supplies from large power stations.

Motherwell.—Under the direction of the Corporation electricity department an electrical exhibition was opened last Friday by Provost Wilson. All the latest appliances were on view and attracted considerable attention.

Neath.—L.G.B. Inquiry.—An inquiry was held on November 20th into the application of the R.D.C. for a loan of £9,636 for electric supply in the parish of Blainhonddan, and the hamlets of Coedfranc, Duffryn, Clydach, Rulais Lower, and Llantwit Lower. There was some opposition on the ground that the scheme would entail heavy rates, but the inspector, Mr. R. H. Hooper, pointed out, on it being suggested that the parish concerned had had no opportunity of discussing the matter, that the question was dealt with by the R.D.C. in May last, that notices were issued, and that the application was in order. In the end, the inspector adjourned the inquiry *sine die* for the supply of a statement showing the difference between loans already sanctioned and the amount actually expended on capital account.

Newcastle-under-Lyme.—We are informed that the new scale of charges mentioned on page 784 ("Lighting and Power Notes"), as having been adopted by the T.C., is for outside arc lamps only.

Northampton.—Municipal Lighting Inquiry.—The T.C. has directed an inquiry to be held into the question of municipal lighting, both by gas and electricity.

Reading.—Bulk Supply to Gas Co.—Notice is given by the Reading Electric Supply Co. of its intention to apply for a prov. order to empower it to supply electricity to the York Town and Blackwater Gas Co. for use within the electrical area of supply of that company.

Rickmansworth.—Prov. Order.—The Colne Valley Electric Supply Co., Ltd., of London, is seeking powers to supply electricity within the area of the Rickmansworth and Chorley Wood Urban Councils, and in the parish of Rickmansworth Rural.

Scottish Prov. Orders.—Notices have appeared of applications for prov. orders for E.L. at Ellon, Ballater, Aboyne and district, and for an extension of the Ayr electric lighting area.

Sedbergh.—The U.D.C. has appointed a Committee to consider terms for a draft agreement relating to the proposed formation of an E.L. company for the district.

Skelton and Brotton.—The Cleveland and Durham County Electric Power Co. has applied for consent to supply current at 11,500 volts to Kilton Mines, in the area of the U.D.C.

South Africa.—According to the local Press, the Municipality of Graaff Reinet, Cape Province, is taking steps to raise a loan of £40,200 for, among other things, installing an electric light system.—*Board of Trade Journal.*

The Parys (O.F.S.) Municipality proposes to expend £3,500 on a turbine, piping, &c., and £1,000 on extensions to the overhead electrical system.—*African World.*

Southend-on-Sea.—Supply to Leigh.—Leigh-on-Sea has now become incorporated in the borough, and at a meeting of the T.C. last week, a Leigh member inquired when the electric light would be extended to Leigh. Alderman Martin replied that as soon as the Council had a sub-station, it would give a supply.

The T.C. proposes to light the area of the town east of the White Horse, by 13 electric lamps.

Stone (Staffs.).—Prov. Order.—The Stone Gas Light and Coke Co. is applying for powers to supply electricity within the areas of the Urban and Rural Councils.

Surrey.—Prov. Order.—Mr. Gilbert Allom, electrical engineer, of London, is applying for a prov. order to enable him to supply electricity in the parishes of Banstead, Walton-on-the-Hill, and Kingswood.

Thornton (near Fleetwood).—Prov. Order.—The U.D.C. has decided to apply for a prov. order authorising it to generate and supply electricity.

Tynemouth.—Quay Lighting.—The Trade and Commerce Committee of the T.C. has adopted the report of the electrical engineer with regard to the electric lighting of the Fish Quay, in which he recommends that Messrs. Robson & Coleman's alternative tender be accepted for wiring the new installation; that the lamps run for street lighting hours be charged at ordinary street lighting rates for 100-watt lamps, and that the intermittent lamps which will be of larger candle-power, and which will be run for short periods only, be charged at the street lighting rate, but that the lamp bulbs be kept up by the Fish Quay department.

Last week a series of "Tricity" cooking lectures and demonstrations was given in Gregg's Café, on behalf of the Corporation electricity department (Mr. C. Turnbull, engineer), the lecturer, as usual, being the inimitable Mr. F. S. Grogan.

Walthamstow.—The oil lamps in Higham Hill Road to Friar's Watch, Billet Lane, are to be converted for electric lighting. At a meeting of the U.D.C., the Joint Committee recommended that the price charged for the current supplied to the tramways be 1⅛d. per unit for the first million and a half units and 1d. per unit in excess of that amount; the current supplied for lighting the car depôts and offices to be assessed at power rates. The Light Railways Committee, in its report, states that it does not agree with the decision of the Joint Committee, and recommends that 1½d. per unit for the first million and a half units and 1d. per unit thereafter should be the charge, and that such recommendation be submitted to the Finance Committee. The Finance Committee, having considered the reference, made no recommendation thereon.

Wigan.—The T.C. has reduced the price of electricity for heating and cooking purposes from 2d. to 1d. per unit.

Yeovil.—Prov. Order.—Messrs. Petters, Ltd., a local firm of engineers, are applying to the B. of T. for a prov. order for E.L. in the borough.

York.—Powers for Extended Supply.—The T.C. has applied for powers to extend its area of supply of electricity so as to include 46 parishes in the North and West Riding, and situate in the Rural Districts of Easingwold, Flaxton, Great Ouseburn, Tadcaster, Bishopthorpe, and Escrick.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Tramway Extensions.—The Corporation intends to apply to the Secretary for Scotland for a prov. order for the extension of the existing tramway lines along Mid-Stocket Road as far as Glenmore Road; from Holburn Street along Union Grove to Queen's Cross; and from Victoria Road, Torry, along Menzies Road to Craiginches. Power is sought to establish railless traction from Castle Street, by way of Justice Street, Commerce Street, and St. Clement's Street, to Footdee and from Schoolhill, by way of Skene Square, to Westburn Road, as far as Foresterhill Road. The Corporation is asking for power to borrow £60,000, and to apply one-third of the profits from the tramway undertaking to such purposes as it may think fit.

Argentina.—The first underground electric railway in Buenos Ayres, between the Plaza Once and the Plaza Mayo, is now completed and is expected to be opened for traffic early next month. Work is also well in hand on a 2¼-mile extension of the line to Caballito.

The work of electrifying the tramway line from Asuncion to the suburb of Villa Maria will probably be completed by the end of the year.

During the current year several proposals were received by the Buenos Ayres Municipality for the establishment of motor-'buses in the city. As the Mayor was not in favour of this service and the petitioners would not accept his ruling, the matter was referred to the City Council. The Public Works Committee of the Council unanimously opposed the establishment of a motor-'bus service. It considers that the electric tramway service has given excellent results. The report of the Committee was approved by the City Council, so that motor-'buses are not likely to be seen on the streets of Buenos Ayres for many years to come.—*Review of the River Plate.*

Baildon.—The U.D.C. has decided to complete the agreement with the Bradford Corporation for the extension of the tramways from Bradford to Baildon.

Blackpool.—Four additional transparent illuminated maps showing the Corporation tramway system are to be obtained, and next summer it is proposed to distribute 100,000 small leaflet maps of the tramway system.

Bournemouth.—Tramway Extension Refused.—The Corporation has refused to extend the tramways to Charminster Road, and as a result, a meeting of the residents has resolved to support an application for powers to inaugurate a railless traction scheme.

Continental Notes.—Spain.—The *Electron* learns that Dr. Pearson, in pursuit of his object of monopolising electric operations, has offered to the Northern Spain railway companies, and also those of Madrid, Zaragoza and Alicante, to take over the traction on their lines and work them by energy from the hydro-electric stations at the Falls of Noguero, Palleresa and the River Ebro, with a view to quadrupling the speed of transit on those lines. The question is now being considered at Paris, with, our contemporary asserts, great promise of a favourable issue to the plans of the proposer of the scheme.

A company has lately been formed at Ferrol to construct an electric tramway between that town and Jubia y Nadi.

Russia.—Work is well in hand on the construction of an electric railway between St. Petersburg, Peterhof and Oranienbaum, a distance of about 36 miles. The line is being built by the Société du Chemin de Fer Electrique d'Oranienbaum, under a 50 years' concession. The power generating station, which will be located near St. Petersburg, will have a capacity of 6,000 kw.

Germany.—An electric ferry boat, which can carry vehicles as well as passengers, has lately been put into service on the Rhine between Godesberg and Niederdollendorf.

Coventry.—New Cars Required.—The Tramways Committee has recommended that ten new cars with covered tops be obtained at an estimated cost of £10,000, and that application be made to the B. of T. for sanction to borrow this sum.

Dover.—The T.C. has under consideration the doubling of the tramway track in London Road between Beaconsfield Road and Lorne Road. A portion of the work is to be carried out at once.

East Ham.—In reply to a letter from the Barking U.D.C., the Electric Lighting and Tramways Committee states that it is not averse to the suggestion that "the existing arrangement between the L.C.C., the West Ham Corporation, the East Ham Corporation, and the Barking Council for the inter-running between Loxford Bridge and Aldgate should be terminated, and that, in lieu thereof, the cars of the three former authorities should have their terminus at Barking Broadway," provided the Barking authority submits terms acceptable to the East Ham Council. The Barking authority thinks that this arrangement will leave it at liberty to arrange with the Ilford Council for inter-running between Barking and Ilford.

Glasgow.—The Tramways Future.—Following upon the annual inspection of the tramway works, &c., on November 20th, interesting points as to the future policy of the department

and the disposal of the yearly increasing financial surplus were given in the speeches at the luncheon in the City Chambers. Lord Provost Stevenson, who acknowledged the civic toast, said that in his opinion the tramways ought to be run at the minimum cost, and the citizens ought to be carried the maximum distance for their money. Ex-Bailie Kirkland, the tramways convener, replying to the toast of the Tramways Committee, proposed by Mr. H. J. Mackinder, M.P., said they had every reason to be satisfied with the progress made up to the present. Not since 1901 had such an important Bill for extensions been presented as the one now in hand, which asked permission to lay not less than 21 miles of double track. They also meant to seek powers for the construction of a new bridge over the Clyde from Oswald Street to Commerce Street. That, in his opinion, would materially lessen the great and growing congestion of traffic which existed in the centre of the city. He wished to state in that connection, however, that he hoped the Corporation in their next provisional order would apply for power to build a second bridge from Dixon Street to Portland Street. To cope with the increasing traffic, which had gone up phenomenally since the doubling of the halfpenny stages, the department had decided to increase the stock of 850 cars to 1,000, and so far as revenue was concerned, they were confidently looking forward to having £50,000 more than last year, when the income for the first time totalled over £1,000,000. They had now, however, reached a very important question, which the Corporation would have to settle once for all—the question of what was to be done with the profits. Some of the members of the Council were of opinion that the tramway surplus should be devoted to the reduction of assessments, and other members thought that the surplus should be utilised for some municipal scheme, such as the building of cottages for the working classes. He, personally, was of opinion that the surplus should be devoted to the reduction of fares and the improvement of the system.

During a visit of the T.C.'s Committee to the tramway works, a demonstration of the new lifting jacks, with which it is intended to equip each car in the service, was given. Already 30 of the new jacks have been issued, and the numbers are being added to by 10 per week.

Huddersfield.—The extensions of the Corporation tramway from Birchencliffe to West Vale, *via* Elland, are again likely to be delayed through disagreement between the Elland Council and the Corporation. In order to make the roadway and track at Long Wall as safe as possible some Elland people are advocating the extension of the wall for another 80 yards, but both authorities think they ought not to be called upon to carry out the work.

India.—Petrol Tramcar Results.—The report of the year's working of the East India Tramways Co., which operates 8½ miles of route and 30 Simplex motor tramcars, is of some interest in these days of rival traction systems.

The average working expenses amounted to 4·93d. per car-mile, inclusive of ·82d. for depreciation. The total expenses were 57 per cent. of the gross receipts, and the fares averaged less than 1d. each. The car-miles run were 566,685, and passengers carried 5,583,291.

London.—Stepney.—In order to relieve the congestion of traffic in East India Dock Road, the L.C.C. proposes to construct a tramway lay-by in West India Dock Road at its junction with East India Dock Road.

Owing to a mishap at the Baker Street sub-station, the trains on the Bakerloo Tube were delayed from 5 o'clock to 5.30 p.m. on Monday.

The Bakerloo extension to Paddington will be opened on Monday next. An escalator will be provided at the new station, there being no lifts.

Northwich.—It has been decided at a town's meeting to form a local motor-'bus company in preference to seeking powers to run a municipal scheme. Twelve members of the U.D.C. have undertaken to invest £1,200 in the company, and a capital of £10,000 is suggested.

Norwich.—Proposed New Tramways.—The Tramway Co. is seeking powers to construct 10 additional lines of electric tramways in the city, with a branch to the village of Thorpe.

Preston.—Tramway Extensions.—By 20 votes to 10 the T.C. has decided to apply for powers for the construction of new tramways, and for the running of motor-'buses within the borough and in the urban district of Fulwood.

Shipley.—The extension of the Bradford Corporation tramways from Nab Wood to Bingley will probably have the effect of making considerable alterations to Shipley residents, as they may be left without a service between Shipley and Nab Wood. The Shipley Council has, therefore, approached the Bradford authorities, and a conference is to take place between the Shipley Highways Committee and Mr. C. J. Spencer, the Bradford tramways manager

South Lancashire.—Last week the new turbine, which has been installed in the South Lancashire Tramways generating station at Howe Bridge, was started up. The chief contractors for the work were Messrs. Brown, Boveri, who supplied the generator; Messrs. Howden, who supplied the turbine; and the Rees Roturbo Co., who put down the condensing plant

Stanley.—A proposal has been made by the local electric tramways company to the U.D.C. with regard to the running of motor-'buses in the district in place of a tramway scheme which has been abandoned, and the matter has been referred to the Highways Committee.

Swansea—Mumbles.—It has recently been announced that the question of electrifying the line between Swansea and Mumbles is under consideration. The Mumbles tramroad is the oldest in the kingdom, having been authorised by an Act dated June 29th, 1804.

Walsall.—Tramway Extensions.—The Corporation is promoting a Bill, the main object of which is to obtain powers to extend the tramways to the outlying districts. The intention is to run railless cars. Four new railless routes are contemplated:—(1) From Rushall, through Pelsall, to Brownhills, and from there back to the present terminus at Walsall Wood; (2) a continuation of the Bloxwich line through Great Wyrley to Cannock; (3) from the existing terminus at the Great Barr boundary on the Birmingham Road to Scott Arms, Great Barr; and (4) along Corporation Street and West Bromwich Road to the Wednesbury boundary at Tame Bridge. In addition, power is asked for authority to continue the last-mentioned service by running motor-omnibuses to West Bromwich, which would be a very great convenience to the public.

Walthamstow.—The general manager of the tramways department is negotiating with the G.E. Railway Co., with a view to the construction of a tramway siding into the north side of the yard at Hoe Street Station, so that the cars may wait for passengers from the trains. The Commissioner of Police is being asked to put a stop to the practice of motor-'buses stopping to pick up and put down passengers on the tramway track in Hoe Street.

TELEGRAPH and TELEPHONE NOTES.

Anglo-Swiss Telephony.—Experiments that have been carried out show that telephonic communication between London and Switzerland can be carried on successfully, and the service, *via* Paris, will shortly be opened to the public. The charges at first will be 7s. for three minutes in the daytime and 4s. at night.

Austria.—A new telephone cable has lately been completed between Vienna and Dalmatia; the line includes not only a land section, but also several submarine sections, linking up a number of islands in the Adriatic Sea. Ordinary bronze wire is used for the landline, and continuously-loaded cable for the underwater portion of the system. Tests recently made between Vienna and Sarajevo, a distance of about 875 miles, were completely successful.

The Government is reported to be preparing a vast telephone programme, which will take four to five years to realise, and involve an expenditure of £3,750,000. In order to avoid raising a public loan, the Government will invite the Austrian contractors—cable and telephone instrument companies, copper works, &c.—to finance the scheme by loans, which the latter will contract with local banks on the security of annual Government repayments, spread over a period of 20 to 25 years.—*Telegraphen und Fernsprech Technik.*

Telephonic communication has been opened up between Vienna and Bucharest. The fee for a three-minute conversation is 6·50 kronen.

Canada.—Owing to a fire of very brief duration in the Bell Telephone Building, Montreal, 13,000 subscribers to the exchange, mainly in the business area of the town, were recently deprived of the service. The fire broke out in the main distributing frame and extended to the intermediate frame, and the former was almost entirely destroyed. Like a previous fire, on July 29th, it was due to a contact with a power circuit outside the exchange. The interruption may last for weeks, as there is not room for a large number of men to work on the cables.

Germany.—Until lately the German Telegraph Administration has made use of several kinds of telegraph instruments, according to the country communicated with. A great improvement has now been achieved by the adoption of a new instrument devised by the firm of Siemens. The instrument belongs to the class which transmit the signals by an automatic sending device, and is thus free from the failings attendant on the human telegraphist. It is able to send 600 signals one way and 1,200 both ways at the same time, or, at the rate of 6 signals per word, 200 words per minute; as against 720 signals and 120 words with the older system. In practice, no saving of staff is achieved by its use, but there is a possibility of a greatly increased utilisation of the existing transmission lines.

It is announced that a wireless service between Nauen and Togoland and German South-West Africa will be opened next year, and will be continued to German East Africa, probably in 1915. Wireless telegrams were exchanged overland between Nauen and Togoland, a distance of about 3,235 miles, early in the present year. Communication is already established between Nauen and Yap, one of the Caroline Islands, which are about 2,100 miles apart, and the extension to Samoa and New Guinea is expected to be completed in April next year.

Holland.—The Second Chamber of the States General has voted the credit for the construction of a telephone cable between the Netherlands and Great Britain.

Hull.—The Corporation Telephones Committee has agreed to purchase from the Government the plant of the late National Telephone Co. in the Hull area at £192,423, the price paid for it by the Government.

Japan.—Preparations are being made to carry out some experiments in wireless telegraphy between the Japanese shore stations at Choshi and Ochüshi and San Francisco, with a relay at Honolulu. Last year the same experiment was not a success, but since then various improvements have been made.

So great is the demand for the installation of the telephone in Japan, that the Government is not able to supply sufficient funds to meet all the requirements promptly. With the view of relieving the pressure, the authorities have now decided to install telephones immediately for such applicants as will agree to bear the cost themselves.

Mexico.—A contract has been entered into between the Mexican Ministry of Communications and Public Works and Senor Isidore Sternefeld, for the installation and working of 20 wireless telegraph stations, each with a radius of 1,500 km., at Mexico City, Tampico, Progreso, and other places.

Russia.—Four wireless stations, built to the order of the Russian Post and Telegraph Administration in the North Polar Sea, have been brought into operation. The stations are intended for the assistance of shipping frequenting the Siberian coast, and to give warning as to the state of the ice and the existence of fogs.

Telegraph-Telephone Combine.—It is reported from the United States that a year and a-half ago the Morgan interests, acting through the American Telephone and Telegraph Co., attempted to absorb all the independent companies, whose appraised value totals something like 400 million dollars, with a view to forming one great combine, but the negotiations broke down.

Wireless on Trains.—Successful experiments with wireless telegraphy on trains have been conducted on the Lackawanna Railroad. The apparatus is installed in the forward part of the train, and an aerial, consisting of four wire rectangles, supported by stanchions 2 ft. high, is placed on the top of each of the carriages. The operator's room is in the rear of the second carriage from the front, under the centre of the aerial. It is reported that the experiments will shortly justify an installation of wireless on all long-distance passenger trains.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney (New South Wales).—March 18th, 1914.—For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" October 31st.

December 31st.—For the P.M.G. Insulators. See "Official Notices" October 31st.

December 22nd. Melbourne Suburban Railways. (1) Track feed boxes, including signal transformers, switchgear and accessories. (2) Track resistances. (3) Impedance bonds. (4) Track relays and relay boxes. See "Official Notices" November 7th.

December 22nd. Melbourne Suburban Railways. Copper track bonds and accessories. See "Official Notices" to-day.

Melbourne.—March 18th, 1914. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

The Finance Committee has recommended the Municipal Council to invite tenders for switchboards to control auxiliary motors at the refrigerating plant at the markets.

Victorian Railways Department.—January 28th. One three-phase alternator, &c.—*Tenders.*

Belgium.—Antwerp.—January 27th. Supply and erection of six electric cranes for the harbour at Antwerp. Deposit, 20,000 fr. Particulars (0·30 fr.), Hotel de Ville, Antwerp.

Brussels.—January 2nd. Construction of the metallic superstructure with the mechanical and electric equipment of the Pont des Hospices. Guarantee deposit, 10,000 fr. Cahier des charges (80 centimes) and other particulars from Bureaux du Service spécial d'Etudes et de Controle des Applications de l'Electricité, 52, Boulevard du Régent, Brussels.

Bingley.—Wiring of electric light installation at Bingley Town Hall. H. Bottomley, Engineer and Surveyor, Town Hall, Bingley.

Birkenhead.—December 2nd. Corporation. Twelve months' supply of electric motors and motor-starters, from ¼ to 15 H.P. See "Official Notices" November 21st.

Bradford.—December 19th. Corporation. One turbo-generator, about 5,000 KW.; storage batteries, boosters and switch and regulating gear; two 1,500-KW. rotary converters, transformers and switchgear. See "Official Notices" to-day.

Bulgaria.—December 9th. The municipal authorities of the town of Varna are inviting tenders for the supply of 1,000 electricity meters, and for the establishment of an electric cable testing establishment.

Canada.—Yorkton (Sask.).—December 22nd. Tenders marked "Tenders for Diesel Electric Machinery" to be addressed to T. F. Acheson, Secretary-Treasurer, Town of Yorkton, for one 500-B H.P. combined unit. Specifications, &c., from M. M. Inglis, electrical engineer, Yorkton.—*Canadian Engineer.*

Coventry.—The City Council proposes to obtain ten additional covered-top tramcars, at an estimated cost of £10,000.

France.—December 12th. The French State Railway authorities (Bureaux du Service Electrique), in Paris (43, Rue de Rome), are inviting tenders for the supply and installation of two batteries of accumulators at the Argenteuil-Triage sub-station.

Germany.—Bremen.—December 10th. Tenders are required for the supply of 10 electric capstans and 19 guide pulleys for Haven II at Bremen. Particulars and conditions of tender (2 marks; stamps not received) from the Hafenbauamt in Bremen.

Glasgow.—December 1st. Electric light installation at Langside Library, for the Corporation. Apply, Office of Public Works, City Chambers. Deposit, one guinea.

London.—L.C.C.—December 3rd. Installation, 225 lighting points, at Chester Road Elementary School, St. Pancras, N.W. See "Official Notices" November 21st.

L.C.C.—December 10th. Installation, 265 lighting points, at Ocean Street Elementary School, Mile End, E. See "Official Notices" to-day.

It being necessary to provide 150 tramcars with trolley equipment, &c., for operating certain through services, tenders are to be invited from selected firms for the supply of trolleys, switches, additional wiring, plough collector gear, &c., for the purpose.

Shoreditch.—December 16th. Corporation. Sub-station plant (transforming and converting plant, starting and controlling apparatus). See "Official Notices" November 21st.

G.P.O.—January 5th. Telephone silence cabinets, for the P.M.G. See "Official Notices" November 21st.

Manchester.—November 28th. Corporation. Two water-tube boilers and superheaters, economisers, coal chutes, ash conveyor, pipe connections, additional stoker shafting and clutches, and pneumatic ash-handling plant at boiler house No. 2, Stuart Street generating station. See "Official Notices" November 7th.

New Zealand.—January 5th, 1914. The Christchurch City Council invites tenders for series street-lighting plant (1,950 metallic-filament lamps) and accessories. A specification can be seen at the B. of T. C.I. Department in London.

Nottingham.—December 1st. Corporation. 750 tons of steel tramway rails, tie bars, steel tramway poles and fittings. Mr. A. Brown, City Engineer, Guildhall. (Deposit one guinea.)

Plymouth.—December 1st. Corporation. Contract No. 31. Ironclad high-tension switch panels. See "Official Notices" November 14th.

Salford.—December 4th. Corporation. Maintenance, repairs and renewals to intercommunication telephone system. See "Official Notices" to-day.

South Africa.—The Tramway Committee of the Johannesburg Town Council recommends that tenders be invited for 15 new tramcars. The general manager of the tramway service also recommends the purchase of four more motor-'buses of the Tilling-Stevens type.—*African World.*

Municipality of Ermelo, Transvaal Province.—December 23rd. Steel pipes and accessories, generating and pumping plant and overhead distribution system, in connection with the domestic water supply and electric lighting systems about to be installed. Specifications from the consulting engineer, Mr. H. Hancock, P.O. Box 62, Klerksdorp; deposit, £1 1s. Tenders to Town Clerk, Ermelo.—*African World.*

South Shields.—December 13th. Corporation. Two water-tube boilers, with mountings and fittings, &c.; one economiser. See "Official Notices" to-day.

Stockton.—December 22nd. Construction of Stockton to Billingham Beck Branch Railway (about three miles in length), for the N.E. Railway Co. C. F. Bengough, Company's Engineer, York.

Sweden.—Stockholm.—Five sluice gates for tube inlet, also accessories; weight of gates, about 85 tons. For Porjus power station.

(*Continued on page* 879.)

A 25,000-kw. PARSONS TURBO-ALTERNATOR.

As a good many of our readers are no doubt aware, the large turbo-alternator set which Messrs. C. A. Parsons & Co. have recently constructed for the Commonwealth Edison Co.'s Fisk Street generating station, in Chicago, has now arrived at its destination.

At the moment it is the largest turbo-generating unit in existence, being designed to develop 25,000 KW. continuously when running on steam at 200 lb. pressure, superheated 200° F., and with a vacuum of 29 in.

The turbine, as will be seen from the views reproduced herewith, is of the tandem type, and similar to, though very much larger than, the turbines installed at the Lots Road power station.

On the one shaft there are mounted a high-pressure single-flow turbine with governor gear at the extreme end, a double-flow low-pressure turbine, an alternator, and—beyond the end bearing—an overhung exciter, the arrangement being shown in our views.

The total length of this power unit is 76 ft. 2 in., the greatest width is 18 ft., and the height above engine room floor level 11 ft.; allowing for the condenser which is suspended beneath the low-pressure turbine, the depth of the complete plant, shown in fig. 13, is about 30 ft.

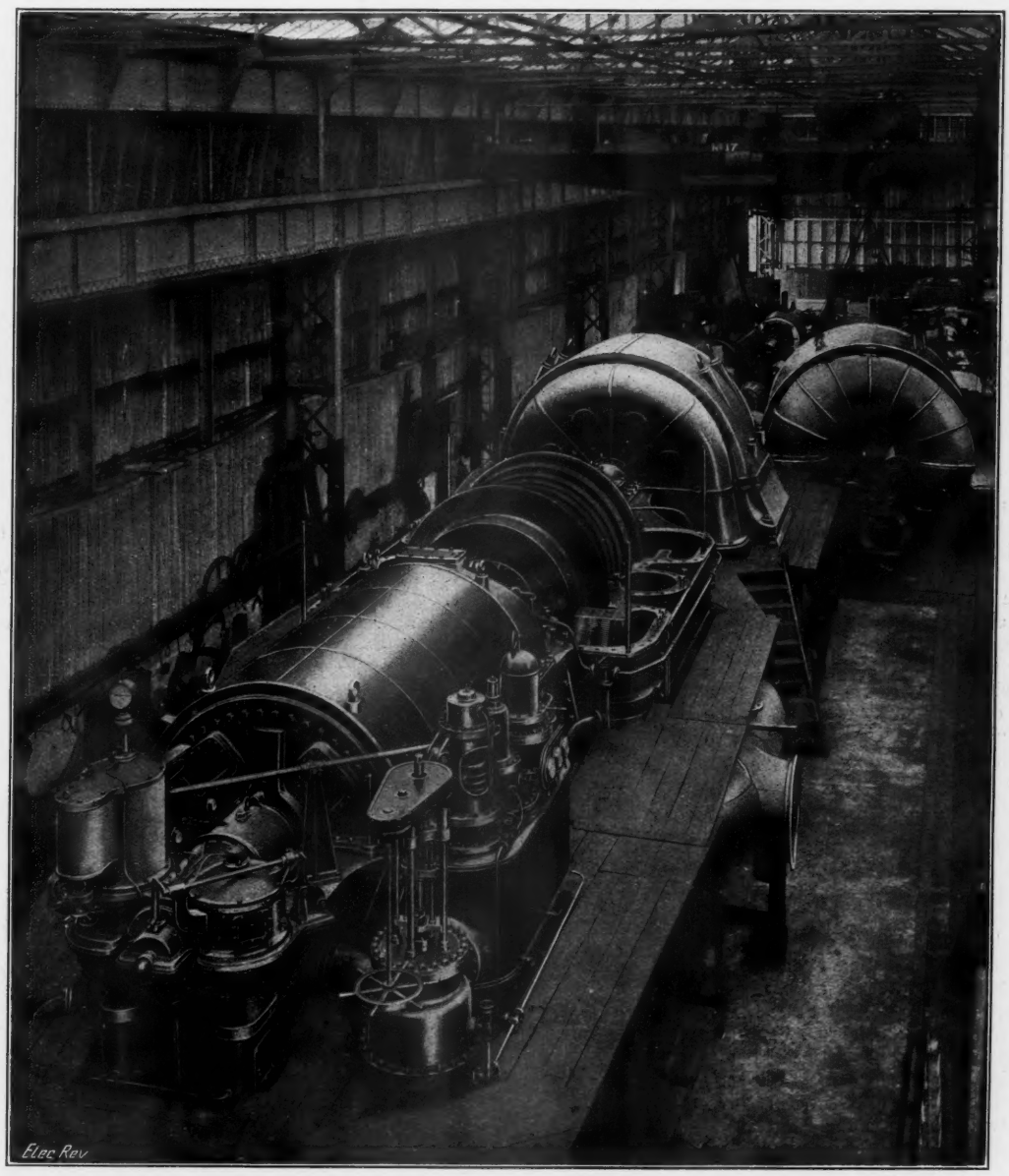


FIG. 1.—25,000-KW. PARSONS TURBO-ALTERNATOR IN THE ERECTING SHOP, SHOWING THE STEAM END.

Under these conditions the guaranteed steam consumptions at various loadings are :—

10,000 KW.	12·50 lb. per KW.-hour.
15,000 KW.	11·65 lb. "
20,000 KW.	11·25 lb. "
25,000 KW.	11·65 lb. "

These figures show that this turbine plant will be remarkably economical over the ordinary loadings likely to be met with in practice; the plant will, moreover, carry momentary fluctuations in load up to 10 per cent. in excess of 25,000 KW.

The high-pressure turbine casing, shown in fig. 6, is constructed in four sections, of cast-steel where subjected to high superheat temperatures, and of cast-iron elsewhere.

The rotor blading in contact with superheated steam is of copper, but for ordinary steam temperatures brass blading is used; the high-pressure turbine contains 64 rows of blad-

ing providing six expansion stages, each blade being caulked in separately with its distance piece. The high-pressure rotor, fig. 7, is a hollow forged-steel drum which is in one piece with the shaft extension at the governor end of the turbine, and is shrunk on and bolted to a big flange on the next section of the main shaft at the other end. The end pressure is balanced by three dummy pistons at the governor end of the rotor.

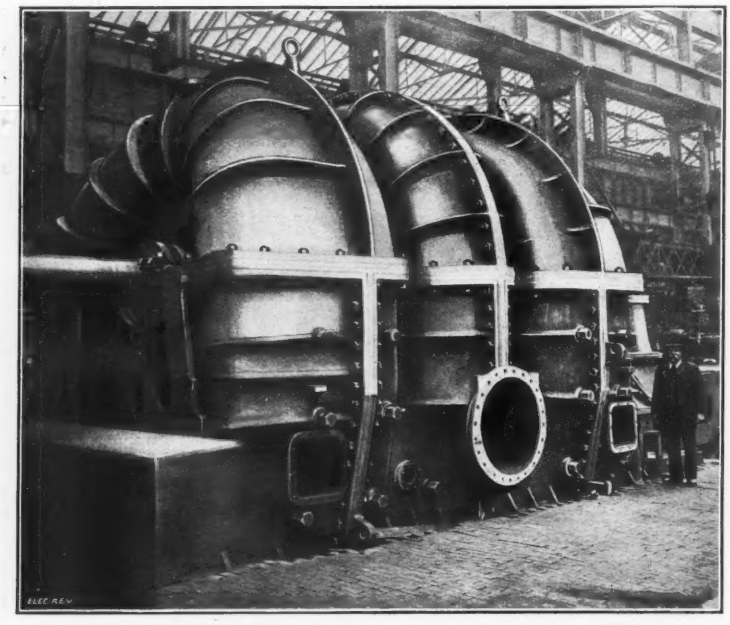


Fig. 2.—The Low-Pressure Turbine Casing.

The low-pressure turbine, the construction of which is shown in figs. 2 and 3, is of the double-flow type originally introduced by Messrs. Parsons, and is connected to the high-pressure casing by 30-in. dia. pipes, delivering steam to a central chamber, from which it passes through six expansion stages on each side to exhaust chambers at each side of the casing, the arrangement being clearly shown in fig. 3.

The exhaust chambers unite on the under side of the turbine, forming a rectangular opening 21 ft. × 12 ft. direct to the condenser, shown in figs. 10 and 13.

Forty-eight rows of blades are fitted, with blades up to 19 in. in length; the blading is stiffened by means of circumferential binding strips and the blade tips are thinned.

The low-pressure turbine casing is of cast-iron, built up in sections, and weighs about 150 tons; the rotor blading is built upon a hollow steel drum rigidly attached to the main shaft at the centre, and also supported at the ends by mild steel diaphragms, which are sufficiently flexible to allow for differences of expansion between the drum and shaft.

Steam packed glands are provided at either end of the low-pressure turbine; the high and low-pressure steam rotors are rigidly coupled together, but provision has been made for the axial expansion of the high-pressure turbine.

Fig. 1 shows the arrangement of valves at the high pressure end of the turbine; a worm on the main shaft operates a worm wheel on either side, on the spindles of the main and emergency governors respectively, the former being coupled to a main double-beat stop valve, and the latter to an emergency valve, in series with the main valve, which automatically closes with a speed increase of 12 per cent. The main governor can be adjusted either from the switchboard, electrically, or on the spot, by hand.

The electric regulating gear consists of a small reversible motor, which raises or lowers the governor sleeve, and so varies the steam admission to the turbine.

Adjacent to the main valve is an overload by-pass valve which automatically admits high-pressure steam direct to the second expansion, when the load exceeds 20,000 KW.

The main governor is specified to maintain the steady speed variation within 3 per cent. between no-load and 25,000-KW. load, and to limit momentary variations to 5 per cent.

As our readers are aware, the Parsons governing arrangement employs an intermittent steam admission, the main valve being attached through its spindle to a spring controlled piston, which continually oscillates in its cylinder according to the variation of the steam pressure beneath it, the latter depending on the to-and-fro movement of a controlling relay valve, which is coupled through a lever to a moving cam on the revolving governor spindle. Some 320 steam admission occur per minute.

The spindle of the by-pass valve is attached to a similar piston, the position of which is controlled by the steam pressure on the underside derived from the first stage of the turbine; when the turbine load increases, this pressure also rises, and lifts both piston and valve, thus automatically admitting steam to the second stage.

A further independent mechanical governor is provided on the main shaft, which can be tripped by hand.

As previously mentioned, the two sections of the turbine are solidly coupled together; the alternator, however, is driven through a flexible claw coupling of the Parsons type.

The alternator is an enclosed machine, which will be ventilated by means of an external motor-driven fan, and is designed for a continuous output of 25,000 KW. at 4,500 volts pressure, 25 cycles, when running at 750 R.P.M.

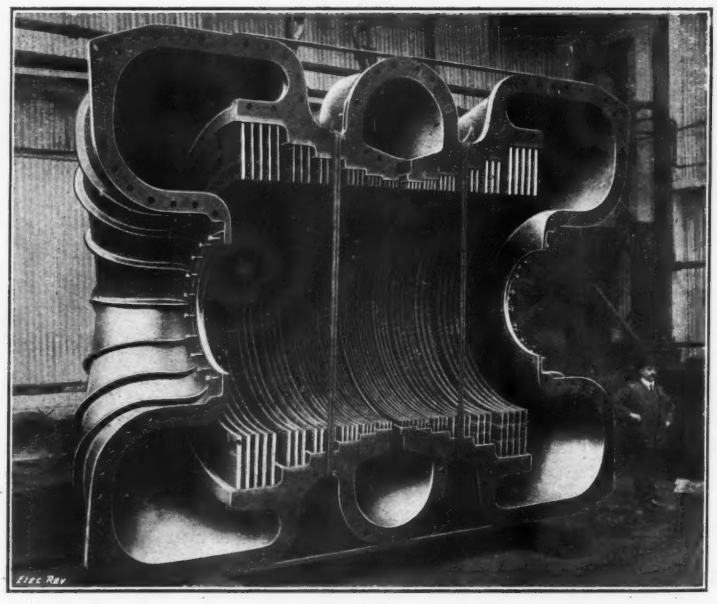


Fig. 3.—Top Half of L.P. Casing Lifted, showing Blading.

The stator consists of top and bottom halves, each of which consists of two sections rigidly bolted together; it

carries 42 groups of core plates, which support 84 stator bars, 10 ft. long, in completely closed slots, $4\frac{1}{2}$ in. deep by $1\frac{3}{4}$ in. wide, there being one bar per slot.

The slot insulation is moulded to shape ; the winding is three-phase, star-connected, and to allow of the lifting of the top half of the stator, the conductors coupling the top and bottom windings are provided with bolted joints.

The rotor, of the cylindrical type, is built up of 32 forged steel disks, with the field winding embedded in peripheral slots ; it is supported on a forged steel shaft, running in two 18-in. diameter bearings, each 48 in. long, and carrying at its extreme end the armature of a 250-volt exciter.

The rotor coils are former wound, embedded in leatheroid troughs which were forced into the core slots by hydraulic pressure, and are rigidly held in position by brass keys.

The coil ends are carried in bronze end-bells, and the complete rotor, shown in fig. 5, is 6 ft. 2 in. diameter and 10 ft. 10 in. long, weighing 50 tons.

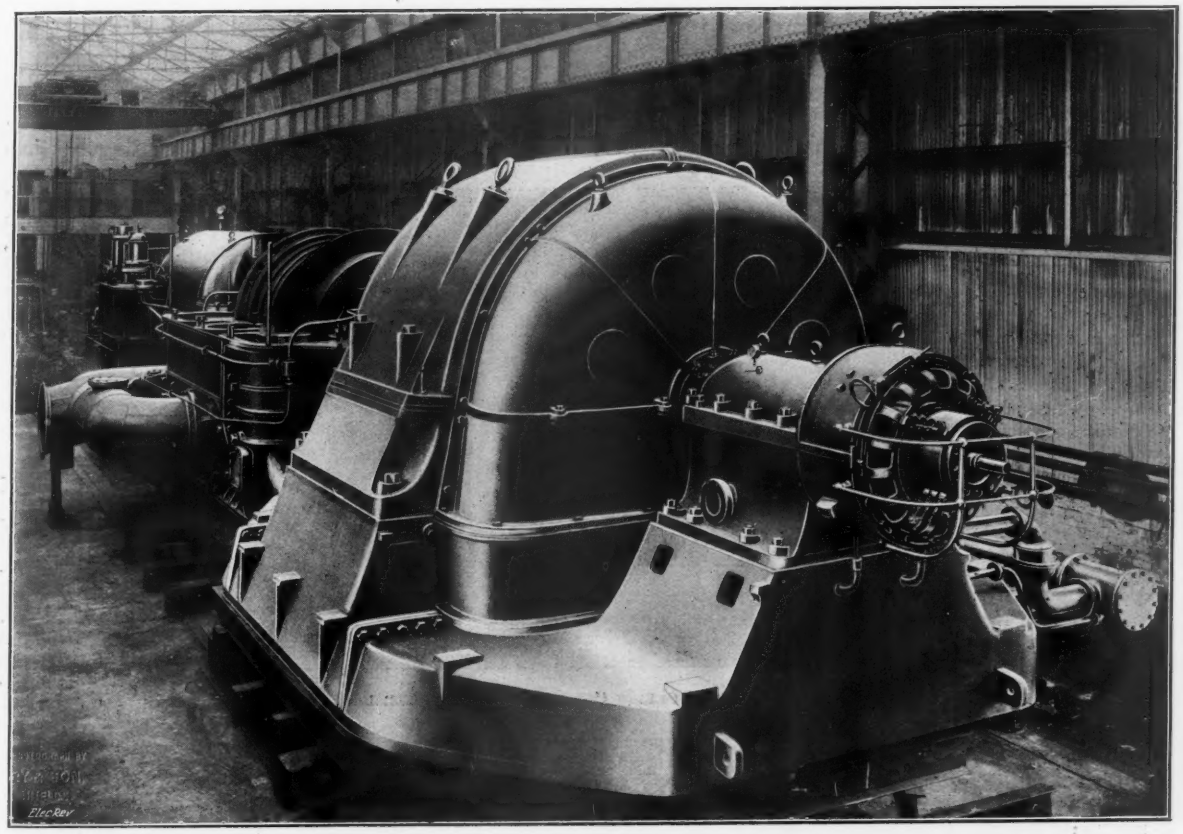


Fig. 4.—General View of the 25,000-kw. Turbine Set, showing the Alternator and Exciter.

The exciter is a shunt-wound four-pole self-excited overhung machine attached to the end bearing casting.

The lower half of the stator casing packed for shipment weighed some 60 tons ; the machine is designed to allow the circulation of 80,000 cb. ft. of air per min., and to have a temperature limit, when running fully loaded, of 70° F.

The condenser, as previously mentioned, is suspended from the underside of the low-pressure turbine ; it consists of a roughly semi-circular shell, with sagging plates and water ends of cast-iron and tube plates of naval brass, which are drilled for two nests of 1-in. diam. tubes. The shell is provided externally with stiffening flanges and four brackets are provided at each side, which rest on springs, and through them transmit a large proportion of the weight of the condenser to the foundations.

The condenser has a cooling area of 39,300 sq. ft., and normal and maximum ratings of 230,000 and 300,000 lb. of steam per hour respectively,

A feed-water heater, of 470 sq. ft. surface, is to be built into the steam entrance to the condenser ; the circulating water for the latter enters at the bottom of the shell, and after passing through the lower and upper nests of tubes is discharged through a 48-in. diameter outlet.

The condenser shell was constructed for Messrs. Parsons by Messrs. Hawthorn, Leslie & Co. ; the circulating and other pumps were supplied by the firm of Henry R. Worthington, while Messrs. Richardsons, Westgarth and Co. supplied the kinetic ejector equipment, the use of which is somewhat of a novelty in American practice, displacing the usual dry vacuum pump.

The functions of this ejector apparatus were fully described in our issue of July 4th last, in connection with a plant installed at the Stuart Street generating station, Manchester. The only mechanism consists of two centrifugal water pumps, one of which draws condensate from the condenser and discharges it to a tank, while the other supplies water (*i.e.*, the condensate) from this tank to the ejector, which, by the combined action of water and steam jets, withdraws the air from the condenser, discharging back into the same tank. A diagrammatic view of the kinetic apparatus is shown in fig. 11, in which A represents the tank, and B the centrifugal pump operating the water jet.

The tank is always full, the overflow being equal to the steam condensed in the condenser. Fig. 13 shows the arrangement of the turbine and condensing plant, in which can be seen the steam jet fitted under the condenser shell and the kinetic ejector, pump and tank installed in the basement. The ejector in this case consists of two units, shown in section in fig. 9, either or both of which can be used ; the steam jet is exhaust steam from auxiliaries, and under air-tight conditions will raise the temperature of the feed water about 3° at full load and 8° at half load. The exhaust steam, in addition to withdrawing the air by its kinetic energy, also heats the feed water, the total heat in the steam and in the vapour withdrawn from the air being absorbed by the condensate.

Careful tests, the results of which are shown in fig. 8, were made with the air pump, the requisite conditions being obtained by blanking off the air suction pipe, and maintaining the desired vacuum with a pre-arranged amount of free air admitted to the suction system, and the

normal quantity of water at a temperature corresponding to actual working conditions. With an air admission of 160 cb. ft. per minute, equal to a $\frac{7}{8}$-in. diameter hole, a 28·6 in. vacuum was maintained, with water at 85° passing through the jets.

The tests show that the Chicago equipment should have an air margin of $2\frac{1}{2}$ times at 29·4-in. vacuum, and jet water with a temperature of 80°, which is much higher than will occur in practice, thus giving a reserve which will ensure economical working, even should air leaks develop.

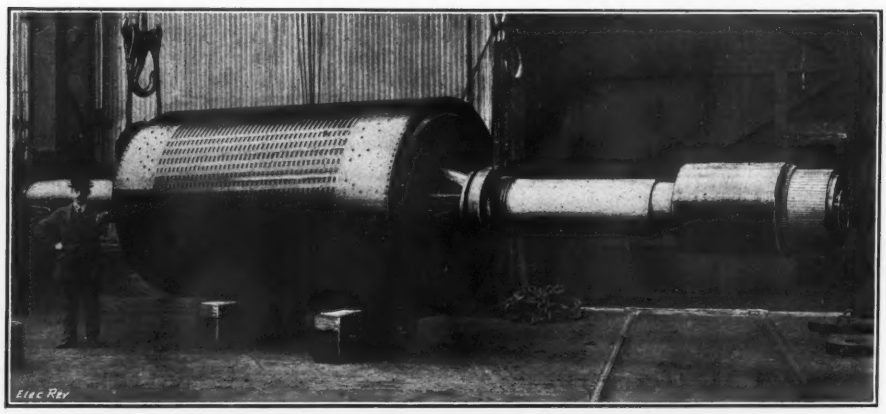


Fig. 5.—Alternator Rotor and Exciter Armature on Shaft.

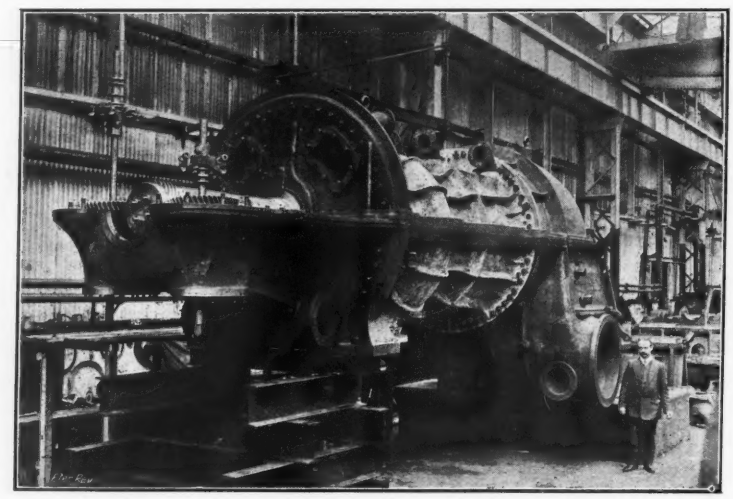


Fig. 6.—High-Pressure Turbine Casing; Governor Gear being Erected

The Worthington pumps in connection with the condenser auxiliaries are nearly all driven by 220-volt, 25-cycle squirrel-cage motors, and comprise a horizontal centrifugal pump for the circulating water with an output of 42,000 gallons per minute; a horizontal two-stage centrifugal hot-well pump, with a capacity of 750 gallons per minute; and a horizontal centrifugal pump for the ejector rated at 4,000 gallons per minute; service and centrifugal boiler feed pumps are also provided in connection with this section of the plant.

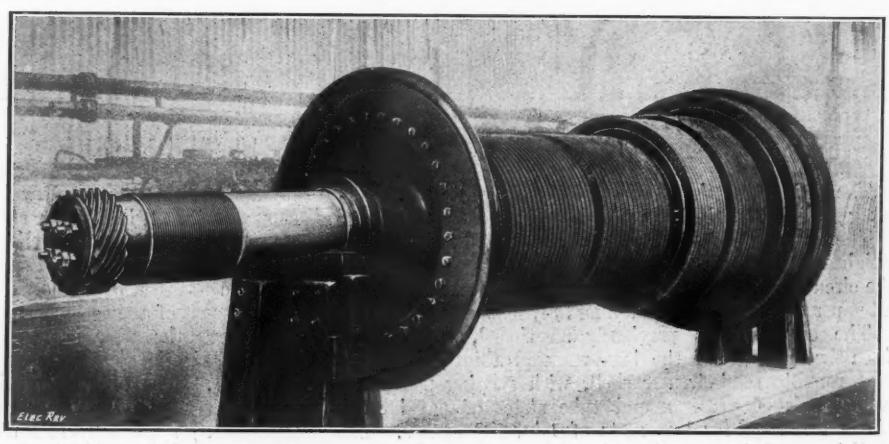


Fig. 7.—Rotor for H.P. Turbine, showing Blading.

In view of the imposing size of this generating unit, it is of some interest to refer briefly to the extension now being carried out at the Commonwealth Edison Co.'s Fisk Street Station, Chicago, of which it constitutes such a notable feature. The present equipment of this station comprises 10 12,000-kw. vertical Curtis turbo-alternators, and it will be noted that the new 25,000-kw. Parsons unit marks a change to the horizontal type of machine, a 20,000-kw. horizontal Curtis turbine set being also on order at the present time, while the necessary space will be available beside these machines for two additional horizontal turbine sets.

The arrangement of the new extension follows generally the usual plan where large units are concerned; it consists of an engine house, with the turbines placed axially, boiler houses running at right angles on one side, and terminating in a "train shed" or fuel reception building which runs across their ends, parallel with the engine house.

Each of the new generating units will be supplied with steam from four marine type Babcock boilers, the two groups occupying one boiler house, and being served by one steel chimney 250 ft. high and 19 ft. inside diameter.

Fuel entering the train shed in railway cars may be dumped or emptied by grabs into receiving hoppers below, from which it passes through two sets of crushers, being reduced in size to ·75 in., and is then carried by bucket conveyors to bunkers over the boilers. The coal storage for the Parsons unit is 225 tons per boiler; the "train shed" contains additional bunker capacity amounting to 3,360 tons, while the receiving hoppers will also hold 1,320 tons. Ash storage is also provided for 1,180 tons. The four boilers for the first turbine are each to evaporate 80,000 lb. of water per hour, and each contains 12,200 sq. ft. heating surface with about 20 per cent. of superheating surface.

Two chain-grate stokers are provided to each boiler, each 10 ft. 6 in. wide and 13 ft. long; the maximum boiler working pressure is 225 lb. per sq. in., with a superheat of some 225° F.

Economisers are provided over the boilers, and induced draught fans to maintain 1·5 in. of draught in the boiler

uptakes. As the station main bus-bars work at a pressure of 9,000 volts, compensating 4,500/9,000-volt transformers are placed between the Parsons generator and bus-bars.

The ventilating plant for this unit includes an air-washing equipment and a fan, driven by a 150-H.P. motor, with a capacity of 80,000 cb. ft. of air per min.

The horizontal Curtis unit which is on order, is of the single-flow type, to run at 1,200 R.P.M.; it is self-ventilated and will generate at 12,000 volts pressure, and 60 cycles, giving its best economy at 15,000 KW. load.

The Commonwealth Edison Co. has also ordered a horizontal 30,000-KW. turbine unit for its North-west station at Chicago, which will follow the arrangement of the Parsons machine in having separate high and low-pressure turbines, and the latter arranged on the double-flow plan.

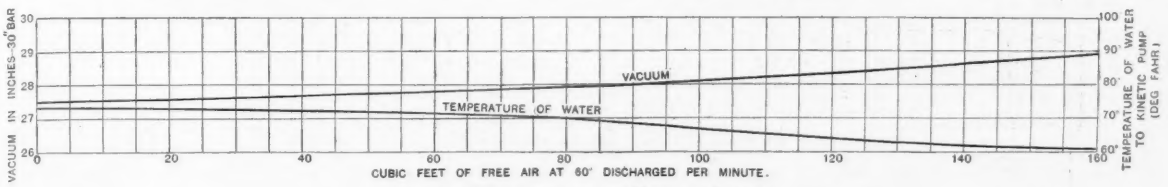


FIG. 8.—TEST RESULTS OF KINETIC PLANT.

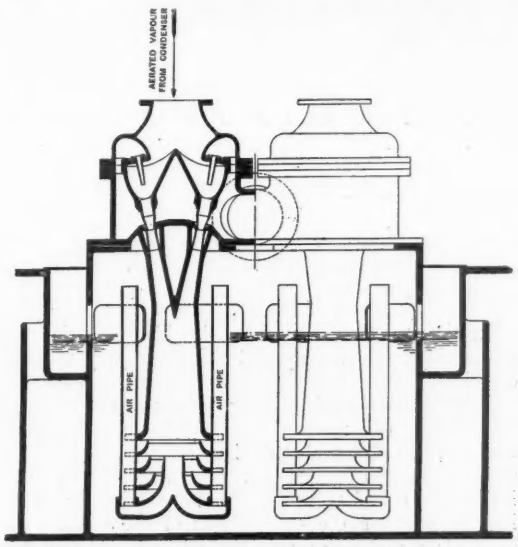


FIG. 9.—SECTIONAL VIEW OF KINETIC EJECTOR.

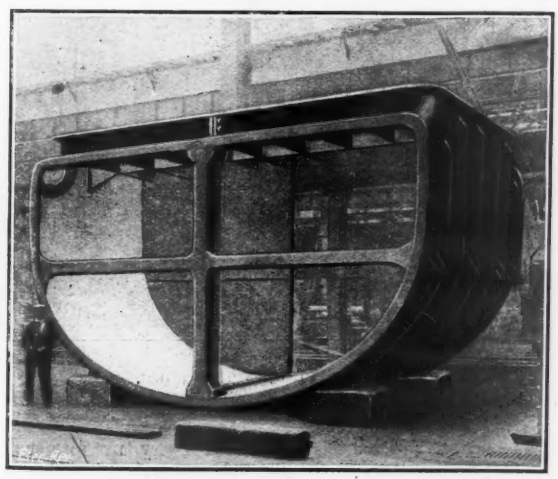


FIG. 10.—CONDENSER SHELL FOR 25,000-KW. TURBINE.

This machine is to run at 1,500 R.P.M., and generate energy at 9,000 volts pressure and 25 cycles.

The complete extension scheme of the Commonwealth Co., which is to be carried out during the next few years, will increase its effective generating plant capacity to some 480,000 KW., this including 210,000 KW. at the Fisk Street station, 84,000 KW. at Quarry Street station, and 160,000 KW. at the North-west station.

These figures give some indication of the enormous scope of electricity supply in the Chicago area, which in 1912 absorbed some 799 million KW.-hours, for lighting, power and traction purposes, supplied by the above company. It is only fair to add that the phenomenal progress made is due in no small degree to the skilful management of its president, Mr. Samuel Insull, who, it may be remembered, as a guest at the last I.E.E. dinner in London, emphasised his views on the future of the electricity supply industry.

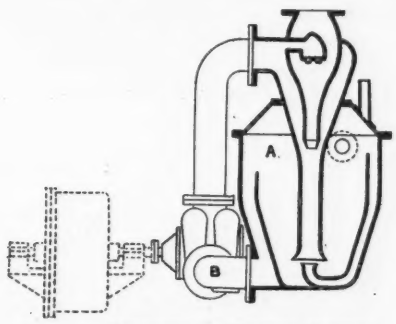


FIG. 11.—DIAGRAM OF KINETIC EJECTOR.

In conclusion, we are indebted to Messrs. Parsons and to Messrs. Richardsons, Westgarth for their assistance in the preparation of this article; we have also drawn on the *Electrical World* for the sectional view showing the complete Parsons turbine unit.

The Commonwealth Edison Co.'s consulting engineers, Messrs. Sargent & Lundy, of Chicago, were responsible for the design of the extensions to the company's plant, and were associated with Messrs. Merz & McLellan, London, in connection with the construction of the Parsons turbine set and condensing plant.

FIG. 12.—VIEW OF KINETIC EJECTOR FOR 25,000-KW. TURBINE.

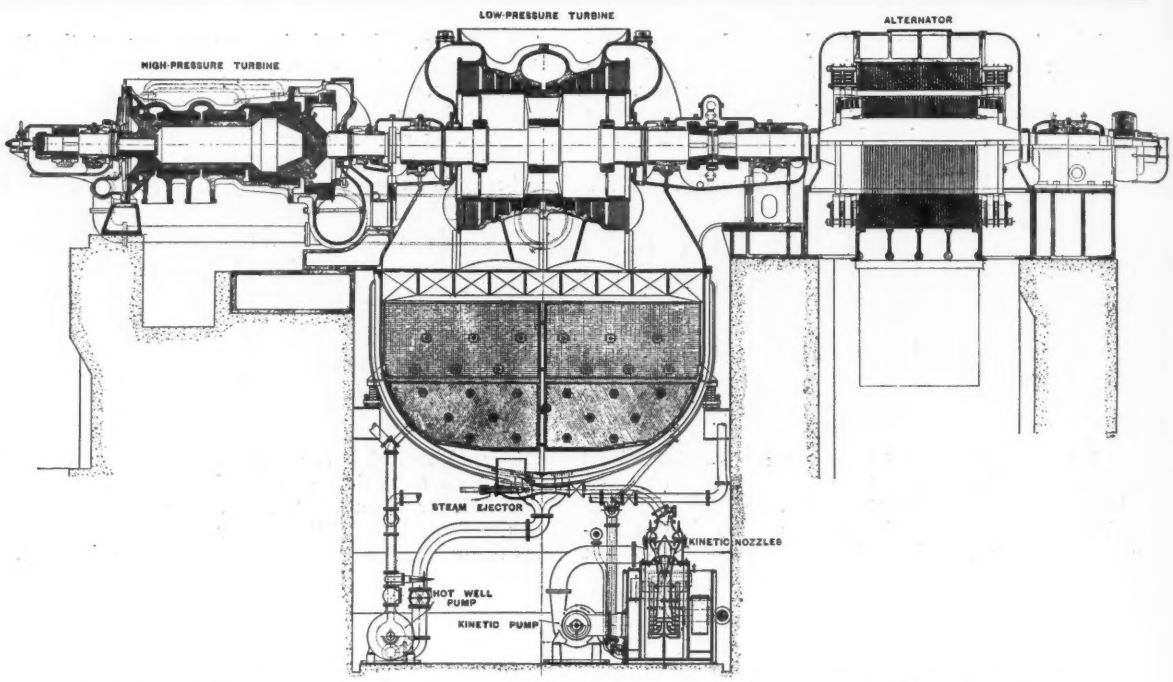


Fig. 13.—Sectional Elevation of 25,000-kw. Parsons Turbine Set, showing Arrangement of Condenser Auxiliaries.
(See pages 871-5.)

THE BRITISH ELECTRIC TRANSFORMER CO.'S WORKS.

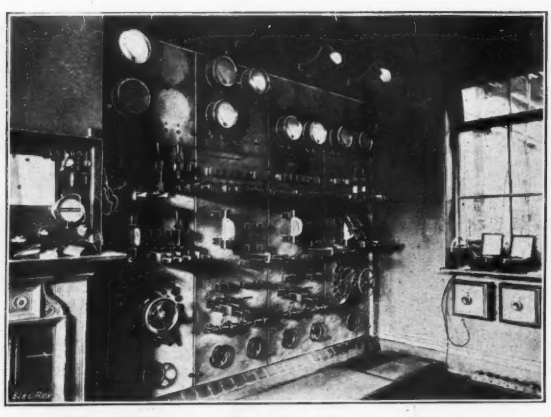
A good many years have elapsed since we illustrated the works of the British Electric Transformer Co., at Hayes.

In the interval electrical engineering and electricity supply has developed enormously and with it the business of the company in connection with the well-known Berry type of transformer.

Originally started in 1901—the Berry transformer having been on the market since 1896—the Hayes works have been enlarged from time to time, the most recent addition being a new bay equipped with crane accommodation, to deal with transformers up to 25 tons in weight. The company has also added the manufacture of the well-known "Tricity" cooking and heating apparatus to its other business, and in this direction also considerable progress is being made. The shops are now electrically driven throughout, power being taken from the mains of the Uxbridge and District Electric Supply Co.; hot-air apparatus has also been installed to maintain the shops at uniform temperature, day and night, in order to prevent condensation.

In the course of a recent visit which we paid to these works the methods adopted by the company were briefly explained to us.

Transformer building being largely a matter of expert assembling of manufactured and semi-manufactured material, the stores play an important part in the works, as large stocks of standard core plates, copper strip and wire, insulating troughs, tubes, Berrite fabric, &c., are held in readiness for the construction of the transformers, of every class, and with a view to facilitating quick delivery.



Switchboard in the Test Room.

General View in the Shops.

The British Electric Transformer Co.'s Works, Hayes, Middlesex.

The constructional features of the Berry transformer are so well known that we do not propose to describe them at length, but in the main shop with the material drawn from the stores, the procedure is, roughly, as follows:—A specially-constructed mandrel is built up with the inner core irons and insulated; the inner secondary winding is then wound on; after that the primary coils are placed in position, the winding process being completed by the outside secondary; after that the iron circuit is completed by the outer core

plates, which are rigidly held in position by means of wire bands.

From the construction it will be noted that the primary winding is totally enclosed by the secondary winding, and that the secondary winding again is protected from external damage by the core plates, which totally enclose the whole of the primary and secondary windings.

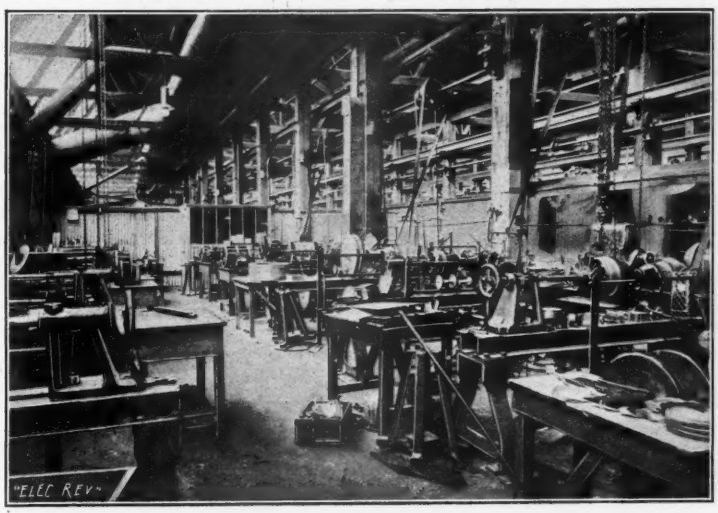
A feature of the Berry transformer is the hand insulation of all the windings, the material employed, Berrite sheet, being a product of the firm, which has special qualities in the way of insulation and mechanical strength, which allow exceedingly rigid constructional methods to be employed.

A special department is given up to small coil winding, and all cotton-covered wire employed is impregnated with Berrite; indeed, this product, in one way or another, is in general use for insulation purposes in the works.

The increase in the use of rotary converter plant throughout the country has created a big demand for transformers having a high reactance—in some cases up to 25 per cent.

The Berry type of transformer is admirably adapted for giving this reactance, without unduly increasing the losses in the transformer itself.

At the present moment, in addition to ordinary transformer work, we are given to understand that the firm have in hand upwards of 100,000 H.P. of transformers of the high-reactance type for use in connection with various railway electrification schemes.

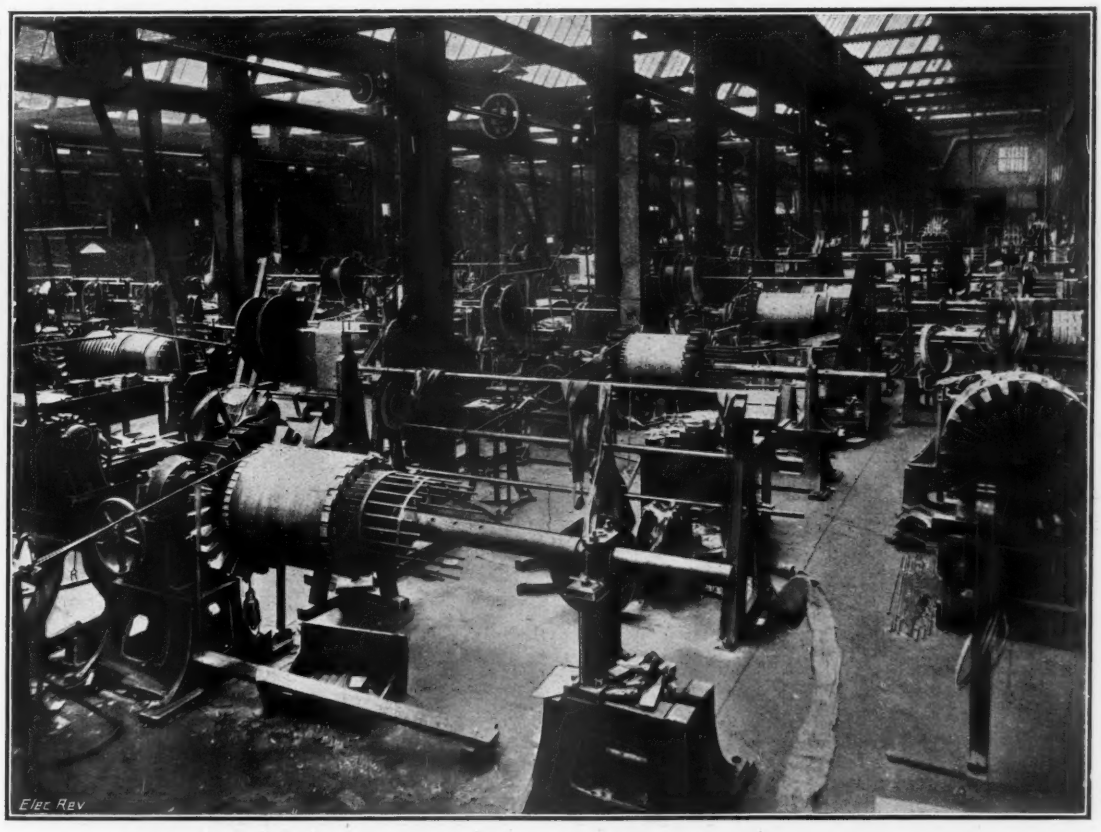


Small Coil Winding Shop.

In addition to transformers, air, oil or water-cooled, the company specialises in transformer kiosks and distributing pillars of various types; the Berry patent series gear for reducing the light-load losses and increasing the overload capacities of transformer substations, and the Berry patent booster transformer for pressure regulation are also well known specialities. In connection with their business in cooking and heating apparatus, a special shop has been set aside, where the modern "Tricity" cooker has been developed. All the apparatus manufactured is iron-clad throughout, so that it is impossible for the user, however unfamiliar with electrical apparatus, to get a shock.

A special test room is provided in the "Tricity" shop for output tests, &c., and complete apparatus is passed to a "finished" store situated in the new bay.

It is almost needless to add that the messrooms for both men and women operators are electrically equipped throughout, no other method of cooking being available.



View showing Transformer Building at the British Electric Transformer Co.'s Works

REVIEWS.

Electricity for Everybody. Second edition. By R. Borlase Matthews, Wh.Ex. London: The Electrical Press, Ltd. Price 5s.

Although this work of reference contains much of interest and value to the general public, the chief object of its author has been to produce a manual for the guidance of those who are called upon to advise upon the applications of electricity, either as selling representatives, or indirectly in their capacity as officials of electricity supply undertakings. Work undertaken with so important an object to some extent disarms criticism which, in any case, can be little more than a divergence of opinion on detail, and the expression of a hope that the demand for this useful publication may render it necessary to issue further editions and give opportunity for those frequent revisions which are so essential when dealing with a business of such vitality, that each recurring season offers new appliances and fresh possibilities.

At the present time a most urgent demand exists for men with a fair foundation of mechanical and theoretical training who are willing to specialise on the selling side of the electricity supply business. That such men are not forthcoming in sufficient quantity, or generally satisfactory in regard to ability and business enthusiasm, is largely due to the fact that many supply authorities expect such duties to be carried out for a wage which a greaser would not accept, without the incentive of payment by results, or reasonable allowance for those expenses which are a recognised part of the selling costs of any other commodity.

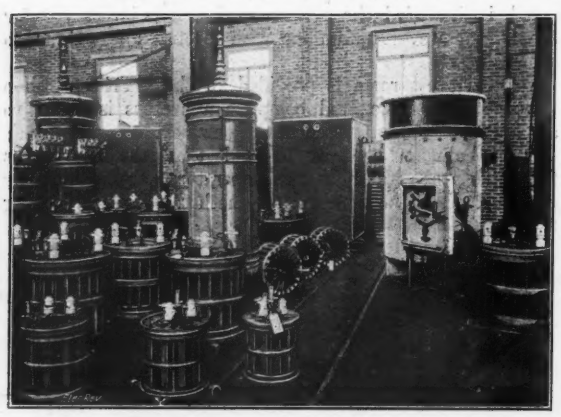
In the hand-book under review many detailed comparisons are drawn between electricity and gas, both for lighting and heating. These are useful, as assisting a beginner in the business to look for points of difference, and to state concisely the advantages of electricity; but, as a whole, they are certainly in need of some revision and excision.

They do not take into consideration the great advances which have been made in the use of gas and gas appliances; this should certainly be done. In no direction need any electricity supply, which is in capable hands, fear the competition of gas for any purpose to which electricity may be applied. It is, therefore, most essential that selling agents should have accurate information with regard to the best that gas can do. The fact will still remain that the average gas appliance in the hands of the average consumer gives results far below those which can be, and are, obtained with good gas appliances carefully attended to.

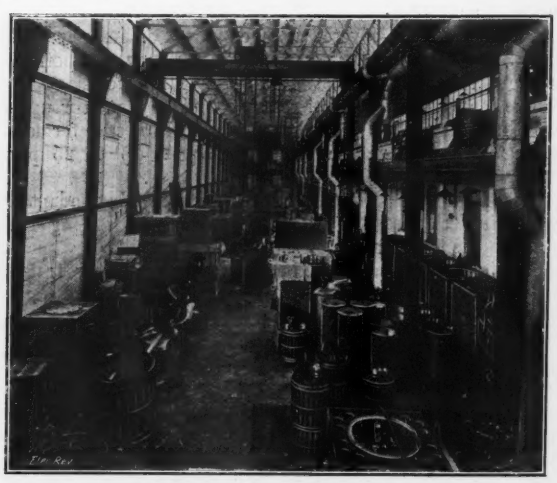
This is not true to anything like the same degree with electrical apparatus, the deterioration of service being far less than in the case of gas;

The Works and Canal.

VIEWS OF THE BRITISH ELECTRIC TRANSFORMER CO.'S WORKS, referred to on pages 876 and 877.



Typical Products in the Works



Interior of the New Bay.

General View, showing Transformer Building, &c.

a constant and permanent advantage in favour of the former.

Throughout the book statements are generally made in terms of the carbon lamp, while the superior efficiency of the metallic lamp is insisted upon. This method of treatment should be looked upon as out of date. The metallic lamp is now practically universal, and statements should be made in terms of it, the carbon lamp being merely mentioned as having a certain limited sphere of usefulness under particular conditions.

The recommendations with regard to the amount of light required for different purposes must be taken with some reserve; so widely is the question affected by position, reflectors, colour and character of surroundings that it is doubtful whether general rules are of much use unless informed by some experience on the part of the reader.

To recommend 8-c.p. carbon lamps for the less important rooms of a house is scarcely wise. In any position bad lighting is an annoyance, and is very apt to form a ground for a general complaint about electric lighting; whilst at the present time the life of metallic-filament lamps is so long that the whole argument that they should only be used where considerable burning hours can be realised loses most of its point, at ordinary tariffs at least.

The data given for power and such domestic uses as heating and cooking form a valuable foundation for the work of the canvasser or constructional engineer; they should be supplemented by his own records of actual experience and comparative cost, which in relation to cooking, at least, will be found even more favourable than the figures given by the author. The expansion of the cooking business is being hampered to-day by the lack of selling agents who have a sound knowledge of simple cooking and domestic economics, which is for this work more important than technical information. With regard to the apparatus, a sufficient familiarity with the electrical principles is readily obtainable from the author's book, and this part of it, at least, may be commended to the attention of ladies who by choice or necessity seek a useful outlet for their knowledge of household management.

So far, the number of lady demonstrators or canvassers employed in connection with electrical work is not great, but there is an immediate field for them in connection with cooking, and in the better-class residential districts a knowledge of decorative principles in relation to lighting might greatly increase their usefulness to the suppliers and their own prospects.

The author's recommendations with regard to expert advice command sympathy; but his observation, that it is not the business of the wiring contractor to design installations, can hardly be admitted with regard to the general run of house and shop work. It is one of the difficulties of the industry that so many wiring contractors do not take the trouble to keep themselves fully familiar with the latest developments of electrical work, and make a study of the design as distinct from the practice of electric lighting. The average consumer is not called upon to ask for any special advice with regard to gas lighting, and he has the right to expect that a tradesman displaying electrical apparatus in his window in the public streets should take the trouble to obtain information and keep himself up to date with regard to the best methods of installing and using the same, putting aside as a secondary consideration those questions of immediate profit and shop-keeping expediency which unfortunately, to-day, too often guide him in advising his clients.

Engineering as a Profession. By A. P. M. Fleming and R. W. Bailey. London: John Long. Price 2s. 6d. net.

The authors explain in a preface to this work that a considerable experience in supervising the training of young engineers has forced upon them the opinion that a large number of failures are due to a lack of knowledge of what constitutes a suitable course of training, and ignorance of the conditions governing engineering employment. In this book very complete information is given as to the best means of obtaining engineering training both of a technical and of a practical character. The curricula obtaining at most of the colleges which have an engineering department, together with the fees, are given in great detail, and the conditions upon which apprentices are received by a large number of engineering firms in the country are explained. Some useful information is also given as to the scope and remuneration of engineering appointments at home and abroad. The book will well repay perusal by all who are contemplating entering the engineering profession.

The Ideal Code Condenser. Second edition. By Alfred Kolkenbeck. London: The Central Translations Institute. Price £1 1s. net.

A perusal of the advance copy of this book reveals how much progress has been made in the art of coding and the cutting-down of the cost of telegraphing. In fact, so many codes and condensers have been put on the market in recent years, that the telegraph bill of the ordinary merchant must have decreased by leaps and bounds, and gentlemen like Mr. Kolkenbeck must be regarded as public benefactors. Increased facilities increase the use of the cables to such an extent that, notwithstanding the amount of revenue code makers deprive them of, the companies still prosper and advance. In fact, they themselves have fathered cheap rates and have brought them down to so low a level that very many people neglect codes with the view of saving time—a matter of great moment.

Mr. Kolkenbeck enables the public to use two or more codes at the same time, which is certainly a novelty and an advantage; particularly, as it is stated, because certain expressions and phrases necessary to make a telegram explicit may be found in one code and not in another.

Mr. Kolkenbeck further states that the Telegraph Administrations of the United Kingdom, France and Germany have, on behalf of the International Telegraph Union, examined the condenser and have issued a certificate in virtue of which the words compiled therefrom cannot be queried or rejected.

CONTRACTS OPEN.

(*Continued from page* 870.)

Wakefield (Yorks.).—December 5th. Twelve months' supply of stores, for Yorkshire (West Riding) Electric Tramways Co., Ltd.

West Hartlepool.—December 3rd. Corporation. Car bodies and trucks; electrical equipments for cars; points and crossings. See "Official Notices" November 21st.

Weymouth.—December 1st. Electric light and power installation at new bakery and stables, for the Co-operative Society (44 lighting points, with fittings, lamps and connecting-up of three motors). Clerk of the works, Cromwell Road.

CLOSED.

Australia.—The following tenders have been accepted by the Commonwealth:—

Victoria.—P.M.G.'s Department.—

50 miles of wire, two twisted conductors, £4 9s. 6d. per mile; 5 miles ditto, three conductors, £6 9s. per mile.—John C. Fuller & Son (J. Paton and Co.).

2½ miles paper-insulated lead-covered cable, 104 pairs 12½-lb. conductors, not served, £363 per mile; 2½ miles ditto, served, £378 per mile; 5 miles ditto 39 pairs, served, £211 per mile.—Callender's Cable and Construction Co., Ltd. (Noyes Bros.).

10 tons twisted-pair outside-distributing wire, £145 per ton; 9 tons tinned-copper rubber-insulated and braided wire, £168 6s 8d. per ton; 15 miles paper-insulated lead-covered cable, 52 pairs, 12½-lb. conductors, served, £246 per mile; 15 miles ditto, 26 pairs served, £166 per mile.—W. T. Henley's Telegraph Works Co., Ltd.

20 miles paper-insulated lead-covered cable, 260 pairs, 12½ lb. conductors, not served, £789 per mile.—Western Electric Co. (Australia), Ltd.

—*Tenders.*

Defence Department.—Stores for the Small Arms Factory, Lithgow; Messrs. Noyes Bros. (Sydney), Ltd., for electric motors.

N.S.W.—Public Works Department.—

Transformers for workshops, Walsh Island, £1,284.—British G.E. Co.

Sydney.—The Electric Lighting Committee has recommended the Municipal Council to accept the following tenders:—

Testing transformer, £27 10s.—Australian General Electric Co.
Copper for bus-bars, £78.—B. I. & Helsby Cables, Ltd.

—*Tenders.*

And that the stock of switchgear be replenished as follows :—

Four 5,000-volt feeder panels, £87 each; two 10,000-volt ditto, £87 each; six 5 000-volt, 200-kw. transformer panels, £71 each; two 10,000-volt ditto, £71 each; 10 415-volt, 200 kw. ditto, £48 each; four 415-volt summation panels, £80 each; seven 415-volt, 200-kw. distributor panels, £47 each; six 200-k.v a. 5,000/415-volt, three-phase transformers, £246 each.—Australian General Electric Co.

One 10,000-volt, 200-kw. transformer panel, £81 10s.—Ferranti, Ltd.

Two 10 000-volt feeder panels, £102 7s. each; one 10,000-volt transformer panel, £94 11s.; one 415-volt, 200 kw. ditto, £46 10s.; five 100-k v a. two-phase transformers, 10,000/415 volts, £700.—Noyes Bros.—*Tenders.*

The N.S.W. Public Works Department Tender Board has opened the following tenders :—

Two 3-ton electric jib cranes for State Brickworks, Homebush Bay.

W. A. Hodkinson	£692
Muir & Neil	1,064
Gordon Marr & Sons	1,120
Babcock & Wilcox, Ltd.	1,296

—*Tenders.*

Blackpool.—The Corporation has accepted the tender of Messrs. James Eaves & Co., of £355 for a new underground transformer chamber opposite the Hippodrome.

Delabole (N. Cornwall).—Contracts for the generating plant, battery, overhead mains, street lighting and private wiring have been secured by Messrs. W. G. Heath & Co., of Plymouth.

East Ham.—The tenders of T. Moy, Ltd., and E. and A. Shadrack have been accepted by the T.C. for the supply to the electricity department of 100 tons of Kirkley nutty slack, at 15s. 6d. per ton, and 100 tons of Cadley Hill nutty slack, at 15s. 3d. per ton respectively.

Faversham.—The T.C. has accepted the tender of Mrs. Davis, of Faversham, for Gillyceidrim washed anthracite coal for the Electricity Works, at £1 14s. per ton.

France.—The French Post and Telegraph Authorities, in Paris, have just placed a contract with Messrs. Geoffroy & Delore, of Clichy (Seine) for the supply of 300 km. of rubber and fire-proof cotton-covered copper wire, and with La Société Industrielle des Telephones, of Paris, for 200 kilometres ditto.; the price ranging from £3 16s. to £4 8s. per kilometre.

Glasgow.—The T.C.'s Sub-Committee on Tramways, Works and Stores has recommended acceptance of the following tenders :—

Cast-steel pipe connections.—Babcock & Wilcox, Ltd.
Cast-iron pipe connections.—Macfarlane, Strang & Co., Ltd.
Slide valves.—Dewrance & Co.
Trolley feed cable.—St. Helen's Cable Co.
Rail anchors.—Carey Patent Anchor Chair Co.
Insulated bolts.—W. C. Yuille & Co , Ltd. ; J. Hally Craig.
Traction lamps.—General Electric Co., Ltd.
Double cotton-covered copper wire.—B.I. and Helsby Cables, Ltd.
Overhead crane.—Alex. Jack & Co.
Tower-wagon chassis —Halley's Industrial Motors, Ltd.
Steel work. &c., Dalhousie depôt.—Redpath, Brown & Co., Ltd.
Trolley wire.—F. Espir.

Gravesend.—The T.C. has accepted the tender of Messrs. Cory & Co., for coal for the electric light works for a period of four years and nine months as follows :—Nixon's Navigation Screenings, 17s. 6d. per ton delivered, subject to market fluctuations, the quantity in any one year not to exceed 4,000 tons.

Hereford.—The T.C. has accepted the tender of Messrs. Cory & Sons, Ltd., for the supply of 2.500 tons of best Cannock rough small coal for the electricity works.

Leicester.—The T.C., on November 21st, accepted the following tenders in connection with the tramway undertaking :—

United Electric Car Co., Ltd.—12 top covers for cars, £101 each.
Walter Scott, Ltd.—Steel rails (180 tons) and fishplates (6 tons), £1,273.
T. Wragg & Sons, Ltd.—Single-way stoneware conduits, 4 in. diameter (2,800 yd.), £126.
Bayliss, Jones & Bayliss, Ltd.—1,000 steel tie bars in three lengths, £79.
Ibbotson Bros. & Co., Ltd.—Bolts, nuts and washers (6 tons), £141.

London.—L.C.C.—The Stores and Contracts Committee has placed a contract for steel conduits and fittings for electric wiring, for the year 1914, with Brotherton Tubes and Conduits, Ltd. Thirteen firms were invited to tender. Contracts for engine packing and asbestos goods have been placed with the following:—R. Beldam, J. W. Roberts, Ltd., A. Terry & Co., Thermofelt, Ltd., and Ward & Davidson, Woods, Sons & Co., J. Wotherspoon & Sons.

The Highways Committee has accepted the tender of Messrs. Hardy & Padmore, at £240, for 36 each cast-iron feeder pillar bases and cases, and that of Mr. J. Billingham, at £199, for 12 tons of standard flanged treadplate.

HAMMERSMITH.—In response to its invitation of tenders for arc lamps for hiring out, the Electricity Committee received 14 tenders, which will be reported upon later.

STOKE NEWINGTON.—The B.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for meters of assorted sizes for two years.

L. & S. Western Railway.—Messrs. Scholey & Co., Ltd., have received from the British Westinghouse Co. an order for their special tool-steel gears and pinions for the whole of the equipments required in the electrification of the suburban lines of this railway. We are informed that this constitutes the largest single order ever placed in this country for gears and pinions.

Rotherham.—The Corporation E.L. and Tramways Department has placed a repeat order with Messrs. E. Bennis & Co., Ltd., for two of their machine-stokers and self-cleaning compressed-air furnaces for a Lancashire boiler.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, November 28th. At 39, Victoria Street. Paper on "Patent Protection," by Mr. A. Abbey.

Greenock Electrical Society.—Friday, November 28th. At 7.45 p.m. At Temperance Institute, West Stewart Street. "Steam Turbines," by Mr. J. H. Parker; "The Entz Reversible Booster," by Mr. P. Kerr.

North-East Coast Institution of Engineers and Shipbuilders (Graduates' Section).—Friday, November 28th. At 7.30 p.m. At Westgate Assembly Rooms, Newcastle-upon-Tyne. Conversazione.

Physical Society of London.—Friday, November 28th. At 5 p.m. At Imperial College of Science. Papers by Prof. H. L. Callendar, Mr. F. J. Harlow and Prof. J. A. Fleming. Also an exhibition of a double-fibre string galvanometer, by Mr. W. Apthorpe.

Manchester Association of Engineers.—Saturday, November 29th. At Grand Hotel, Aytoun Street. Paper on "Pattern-making Department in an Engineering Works," by Mr. T. Roberts.

Institution of Electrical Engineers (Western Section).—Monday, December 1st. At 4.30 p.m. At South Wales Institute of Engineers, Cardiff. Paper on "The Characteristics of Insulation Resistance," by Mr. S. Evershed.

Society of Engineers.—Monday, December 1st. At 7.30 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Paper on "The Corrosion and Rusting of Iron," by Mr. E. K. Rideal.

North of England Institute of Mining and Mechanical Engineers.—Monday, December 1st. At 8 p.m. At Chemical Theatre, Armstrong College. Fourth Lecture on "Utilisation of Fuel," by Prof. J. W. Cobb.

Royal Society of Arts.—Monday, December 1st. At 8 p.m. At John Street, Adelphi. Cantor Lecture on "The Measurement of Stresses in Materials and Structures," by Prof. E. G. Coker.

Rontgen Society.—Tuesday, December 2nd. At 8.15 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Papers on "Sterilisation of Milk by Electrified Gas," by Dr. Hampson, Prof. W. G. Duffield and Mr. T. Murray. On "Some New Radium-emanation Applicators," by Mr. C. E. S. Phillips.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, December 2nd. At 7.30 p.m. At the University (Physical Lab.). Paper on "The Characteristics of Insulation Resistance," by Mr. S. Evershed.

Institution of Civil Engineers.—Tuesday, December 2nd. At 8 p.m. At Great George Street, S.W. Ordinary meeting.
Friday, December 5th. At 8 p.m. Students' meeting. Paper on "The Liverpool St. Extension of the Central London Railway," by Mr. H. V. Hutt.

Institution of Civil Engineers of Ireland.—Wednesday, December 3rd. At 8 p.m. At Dublin. Ordinary meeting.

Dynamicables.—Wednesday, December 3rd. At the Trocadero. Dinner.

Institution of Electrical Engineers.—Thursday, December 4th. At 8 p.m. At Victoria Embankment, W.C. Address on "Electricity Supply in Large Cities," by Dr. G. Klingenberg.

Chemical Society.—Thursday, December 4th. At 8.30 p.m. At Burlington House, Piccadilly, W. Ordinary scientific meeting.

Faraday House Old Students' Association.—Friday, December 5th. At 7.30 p.m. At Holborn Restaurant. Annual smoking concert.

Institution of Mechanical Engineers.—Friday, December 5th. At 8 p.m. At Storey's Gate, S.W. "Thomas Hawksley" Lecture on "Water as a Mechanical Agent," by Mr. E. B. Ellington.

Junior Institution of Engineers.—Friday, December 5th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Presidential Address, by Sir Boverton Redwood, Bart.

Manchester Association of Engineers.—Friday, December 5th. At Whitworth Institute, Whitworth Park. Conversazione.

Salford Technical and Engineering Association.—Saturday, December 6th. Visit to Salford Electricity Works. At 7 p.m. At Royal Technical Institute. Annual Meeting.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, December 1st.—"A" Company. Technical instruction, 7 p.m. to 10 p.m.

Tuesday, December 2nd.—"B" Company. Ditto.

Wednesday, December 3rd.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.

Thursday, December 4th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.

Friday, December 5th.—"D" Company. Technical instruction, 7.30 to 9.30 p.m. Special class on Crossley engine, 7 p.m.

Saturday, December 6th.—Headquarters will be opened for the transaction of regimental business from 10 a.m. till 12 noon.

(Signed) R. HOLT WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

Australian Electricians' Wages.—Many of our readers will be interested in the rates which two recent awards by Mr. Newbery have made compulsory in the State of New South Wales. One award deals with the employés of the Sydney City Council, the other affects the general public. The awards are to remain binding for a term of three years, and have many identical clauses.

For Council employés the minimum rates are to be:—

Electrical fitters and instrument makers, 12s. per day.

Electrical mechanics, consumers' attendants, electrical mechanics on overhead work, and meter fixers, 10s. 8d. per day.

Cable jointers, 12s. 6d. per day.

Arc lamp trimmers, 9s. 6d. per day.

Motor inspectors, 11s. 2d. per day.

Mechanics employed on motor breakdown staff, 11s. 8d. per day.

Meter testers and repairers and arc lamp testers, 11s. 8d. per day.

Shift electricians at sub-stations, 13s. 2d. per day; assistant shift electricians, 9s. 8d. per day; senior shift electricians, 14s. per day.

Switchboard attendant at power house, 9s. per day for first 12 months; 10s. per day afterwards if over 21 years.

Principal battery fitter at Town Hall, 13s. 8d. per day.

For employment outside the City Council the minimum rates of wages are:—

Shift electricians, 1s. 6d. per hour.

Installation electricians, 1s. 6d. per hour.

Electrical fitters, 1s. 6d. per hour.

Instrument makers and fitters, 1s. 5d. per hour.

Battery fitters, 1s. 6d. per hour.

Electrical mechanics, 1s. 4d. per hour.

Linemen, 1s. 2d. per hour.

Cable jointers, 1s. 6d. per hour.

Arc lamp trimmers, 1s. 1d. per hour.

Leading hands are to be paid 1s. 6d. per day over the above rates.

Electricians in charge of installations are to be paid not less than 13s. per day when the capacity of the plant is less than 75 KW., and not less than 15s. per day when it is over that amount.

The minimum weekly rates for apprentices, both for Council and general work, are to be:—First year 7s. 6d., second year 12s. 6d., third year 17s. 6d., fourth year 25s., fifth year 35s. The standard hours to be 48 per week. Overtime, time and a half till midnight, double time after that period.

Living allowances at the rate of 6s. per day to be paid on the first two days, and 5s. per day for the following days, after that at the rate of 25s. per week.

Preference of employment, other things being equal, is to be given to members of the Electrical Trades Employés' Union.

The awards contain a number of definitions as to the duties of the various grades, and a number of other regulations as to suburban and emergency work, employment on Sundays and holidays.

The rates are in all cases an advance on those at present paid, and are such that workers in this country cannot but regard them with interest. It must, however, be remembered that the cost of living is much higher in Sydney than in this country, and that when the margin between the week's wages and the necessary expenses of the home is considered in the two cases, the balance in favour of Australia is not so great as might be inferred at first sight.

Power Conditions in North-West U.S.A.—Up to 1910, the rapidly increasing demand for power in the Pacific North-West districts taxed the resources of electric supply companies in that region to the utmost, but recently the demand has slackened, so that all the operating companies have an excess capacity ranging from a few thousand kilowatts to a considerably greater amount. Unless industrial developments absorb this excess, it will be some years before the construction of new power plants will be warranted. Supply rates all over the country have decreased constantly, in many cases to 35 per cent. or 50 per cent. of their value a few years ago. At present the rates in the North-West compare favourably with those in any part of the States.

Streams on the west side of the Cascade Mountains in Washington and Oregon have a rapid fall and abundant and comparatively well regulated water. Storage capacity is, however, needed to maintain operation during February and September or October. The prevailing public opinion is that these streams could easily be harnessed and made to yield enormous revenues. In the *Electrical Review and Western Electrician*, Mr. W. E. Herring points out the constructional difficulties and costs involved. Transport difficulties are great, transmission lines must be very long, and steel tower lines involve constructional difficulties. Local timber is rarely useful for poles, but a wide belt of trees, averaging 150 ft. in height and often attaining 250 ft., must be felled. The average cost of a H.T. line in heavily timbered country is £800 or more per mile according as wooden poles or steel towers are used. A city distributing scheme costs from £1,500 per mile where wooden poles are used to £8,000 per mile using underground ducts. Auxiliary plant and equipment designed to enhance security of supply absorbs much capital. Natural causes of interruption are many, and the repair of damage (apart from incidental losses) is costly. The Seattle supply company has £54,000 invested in storage cells which will carry full load for 25 minutes only. Only about 50 per cent. of the horse-power available at the stream or 70 per cent. of the power generated reaches the consumer. The initial cost of a complete hydro-electric development is from two to four times that of a steam plant of equal capacity.

The Puget Sound Co. supplies from Tacoma North to the British Columbia line from four water and six steam plants totalling 105,440 rated H.P. (76,000 H.P. in one water plant). Supply in the remainder of the western portion of Washington and Oregon is by the following undertakings:—Oregon-Washington Corporation: one water, two steam stations; total, 3,090 H.P. (887 H.P. hydraulic). Portland Co: Three water, seven steam stations: total, 81,270 H.P. (55,310 H.P. hydraulic). Oregon Co.: One water, two steam stations; total, 5,620 H.P. (666 H.P. hydraulic). California-Oregon Co.: Two water stations; total, 8,300 H.P. The new N.W. Electric Co. has a 16,000 H.P. hydro-electric plant at Washington and a 5,000-H.P. steam station under construction in Portland. A number of developments, admirable in every other respect, have not been carefully investigated, because no market exists for the output of which they are capable. Under present conditions, it will be years before these developments can be exploited. One company, at least, has instituted an aggressive campaign to increase industrial activity in its district. As an inducement, rates less than £4 3s. per H.P.-year have been quoted to large power users for 24-hour supply. The power cost of manufacturing per month, assuming use of 100 H.P., 10 hours per day at 75 per cent. load factor is, in:—Boston, £194; Philadelphia, £173; New York, £144; Chicago, £130; Cleveland, £115; Pittsburg, £86; Buffalo, £38; Seattle and vicinity, £31 to £77; Niagara, £29.

There are unlimited power possibilities on streams in Washington and Oregon, but until the country is more densely populated and until industrial activity is greater, there will be no such development of these streams as has occurred in other parts of the States. Low-head developments, the rule rather than the exception in the Eastern States, are non-existent in the North-West.

The Largest Aerial Cableway in the World.—The *Electrical Review and Western Electrician* states that plans are being completed for an electrically operated 75-mile cableway to give access to the Vale of Kashmir from the plains of the Punjab in Northern India. The longest cableway at present working is in Argentina and is 22 miles long.

The ruggedness of the mountainous district, the treacherous character of the frequent landslides after heavy rains, and the falling of heavy boulders, make the construction of an ordinary railway impracticable.

Two separate ways will be set up, side by side, about 9 ft. apart, and will permit of uninterrupted transport of freight on incoming and outgoing lines. The cable will be about 1·5 in. in diameter, and arranged in 5-mile sections. A system of springs, thoroughly anchored and with heavy counterweights will be employed to take up expansion and contraction due to heat and cold. The spans will be about 2,400 ft. each, with a fixed cable upheld by iron pillars and lattice work towers, some of which will be 100 ft. high. In some cases the spans are across canyons 1,200 ft. deep. The cars will be of steel, and each capable of holding from 335 to 450 lb. of freight. The transfer of the cars from one section to another will be automatically done by revolving drums, which will affect release of the cars and renewal gripping to the hauling ropes of the next section. The system will be electrically operated from a hydro-electric station near the town of Rampore.

The estimated cost will be about £300,000, and the inception of the scheme is due to a Canadian military engineer temporarily in the service of the Kashmir Government.

"The Voysey Inheritance."—Once again the Electrical Trades Benevolent Institution is indebted to the Garrick Dramatic Society for an excellent entertainment and for financial benefit to its funds, the exact extent of which we hope to announce in due course. So far as the Dramatic Society is concerned, the performance at the Court Theatre was all that could be desired, but as might be anticipated from what we said in our last issue, the electrical support was not so good as last year. Mr. Duddell, president of the I.E.E., was present, and among others from the manufacturing and other sections of the industry who put in an appearance were Mr. H. Hirst, Mr. E. L. Byng, Mr. H. H. Berry, Mr. F. H. Nalder, Mr. Rawlings and Mr. F. J. Walker. An electrical man might have expected in looking round the building to see many more familiar faces, and so he would have done but for the fact that a number of prominent men who had purchased tickets with the object of assisting to ensure the success of the evening were unable to occupy their seats. There is nothing so inspiring to actors, and especially to a society of amateurs, as a full house; on another such occasion no doubt purchasers will be able to think of this in advance and suitably dispose of tickets that they cannot personally use.

Electrochemical Works in Sweden.—A big factory has just been completed near Johannesburg, in Sweden, for the manufacture of carbide of calcium and nitrate of calcium by the carbon improved process. The novelty of this method consists in the addition of a little carbide spar to improve the quality of the product. Four 400-KW. A.C. furnaces are installed for the manufacture of carbide of calcium, and six 2,666-KW. three-phase furnaces for the nitrate. The power house has a capacity of 15,600 KW. The entire hydro-electric installation has cost £250,000, of which the electric equipment stands for £42,000, the transmission lines £108,000, and the canals and dams £50,400.—*Journal du Four Electrique.*

Football.—On Saturday last the teams of Cunningham, Ltd., and Electrical Installations, Ltd., second eleven, met on the former's ground, the game resulting in the defeat of the visitors by six to nil.

London Electric Supply Companies and the Purchase Date.—With reference to our note of last week concerning the application to Parliament by the County of London Electric Supply Co., Ltd, for powers to postpone the date of purchase, the notice of the company appeared in the *London Gazette* for November 25th. The application is intended to be made by, or on behalf of, the County Council either alone or in conjunction with any one or more of the other London electric supply companies for leave to bring in a Bill for the following purposes:—

To enable the County Co. and any other or others of the London Electric Supply Companies respectively, and any one or more of such companies on the one hand and the London County Council on the other hand to enter into and carry into effect agreements for the postponement of the date at which the Council may proceed to purchase the undertakings or parts of the undertakings of the London Electric Supply Companies or any of them, and for a variation of the terms and conditions under which such undertakings or any of them are purchaseable, and making new provisions with regard thereto, including any extension of powers of purchase in reference to generating stations or portions of undertakings outside the county of London, and to provide for the validity of any such agreement, notwithstanding that the same may restrict the right of the Council under or may be inconsistent with or contrary to the provisions of Sec. 23 of the London Electric Supply Act, 1908, or any other provisions of that Act or any other Act, and whether affecting the company or companies parties to such agreement or any other or others of the London Electric Supply Companies not parties to such agreement.

To sanction and confirm and make binding any agreement or agreements already made, or which may hereafter be made, between the County Co. and any other or others of the London electric supply companies, or any one or more of them, on the one hand, and the Council on the other hand, for any of the purposes referred to in this notice.

The Bill may make provision for the postponement of the date at which the Council may proceed to purchase the undertaking of the County Co. and the undertakings of the other London electric supply companies respectively, and for the alteration or amendment of the terms and conditions under which such undertakings or parts of undertakings respectively, or any one or more of them, may be purchased, and make new and extended provisions in reference thereto, including any extension of powers in regard to purchase by the Council of generating stations and portions of undertakings outside the county of London.

There was some discussion on the matter at Tuesday's meeting of the Council. Major Levita asked for information, and in reply Mr. G. H. Hume, speaking for the London Electricity Supply Committee, said that they could do nothing until the Bill was deposited in December. Their officers would then report. The Committee was not aware of what lay behind the notice.

Late Legal.—The Osram Lamp Works, Ltd. Judgment against Oro Light Co.—In the Chancery Division, before Mr. Justice Astbury, on Wednesday, November 26th, Mr. J. H. Gray, on behalf of the plaintiffs, in the action of the Osram Lamp Works, Ltd., *v.* the Oro Light and General Supply Co., Ltd., moved for judgment in default of defence. He said a defence was delivered, but was afterwards withdrawn. The action was for infringement of two patents.

His Lordship: Are these old friends?

Mr. Gray: Yes. Counsel pointed out that the minutes of judgment were in the usual form. They provided for an injunction, delivering up or destruction, and for an inquiry as to damages.

His Lordship: Under what circumstances did they withdraw their defence?

Mr. Gray said he did not know; he only knew there was an application to withdraw it. The defendants asked for leave on November 10th, they got leave on the 12th, and the defence was withdrawn on the 15th.

His Lordship gave judgment in the usual form.

Attack on a Sub-Station.—During the meeting of Trade Unionists at the Albert Hall, London, on Wednesday last week, a large number of students made an attack on the sub-station of the Kensington and Knightsbridge Electric Light Co., which is situated at the rear of the Hall, with a view to extinguishing the lights in the Hall, and throwing the meeting into confusion. Telephones, electric lamps, switchgear, &c., were broken by the mob, which broke down the gates and rushed into the station, but the lights were not affected. Two of the marauders—Angus McCallum and G. W. Elkington—were captured, and were charged next day; they were remanded on bail.

Appointments Vacant.—Senior and junior draughtsmen for Birmingham electric supply department (senior £130 to £160, junior £80 to £130). Switchboard attendant, for Portsmouth Corporation (30s.). Particulars are given in our advertisement pages.

Engineering Trade Conference.—The *Financial Times* states that a conference was held last week at Caxton Hall, between the Engineering Employers' Federation and representatives of unions concerned in the trade, when a demand was put forward by representatives of the unions for a 48-hour week. The matter was considered and the employers promised to communicate the matter to the companies connected with the Federation.

L.G.B. and Electrical Publicity Expenditure.—The Associated Municipal Electrical Engineers (Greater London) have been in communication with the L.G.B. regarding the legality of expenditure on publicity and advertising matters in connection with municipal electrical undertakings. The letter to the President of the L.G.B., amongst other things, pointed out that "According to the reports in the Press, he was good enough to state when he recently received a deputation from the British Commercial Gas Association, that he was in full sympathy with the objects of the Association, and considered money spent in support of its work would be money wisely spent by gas undertakings, and that if the money so spent were described as payment for 'goods supplied and services rendered'—the goods supplied being the 'Bulletin,' the advertisements inserted by the Association in papers having a national circulation, and the samples of literature sent by the Association to its subscribers—such payments would not be made the subject of a surcharge by the Local Government Board." The letter, in conclusion, asked whether his opinion applied equally in the case of municipal electrical undertakings.

In reply, the L.G.B. draws attention to a paragraph in its letter to the President of the British Commercial Gas Association, mentioning that the views there expressed as to the purchase of literature, is applicable to municipal electrical undertakings.

The paragraph referred to runs as follows:—"I am to add, however, that the Board have been advised by the Law Officers of the Crown that publications containing information so immediately connected with the discharge by a local authority of their duties, as to be likely to enable them to discharge those duties more efficiently, might legally be purchased by the local authority. The question of the legality and reasonableness of expenditure incurred in the purchase of the publications would, in the case of a local authority whose accounts are subject to audit by a district auditor, be one for consideration in the first instance by the auditor at the audit."

Meeting of Creditors.—A meeting of the creditors of John Samuel Richardson, electrician, 29, Frodsham Street, Marfleet, Hull, was held at the office of the Hull Official Receiver on Tuesday. Debtor's liabilities amounted to £95, and his deficiency was estimated at £81. He attributed his failure to the law costs in an unsuccessful action brought by him for damages for personal injuries received. His affairs were left in the hands of the Official Receiver.

A Manchester Staff Dinner.—The first staff dinner of the electrical department of the Calico Printers' Association, Manchester, was held in the Albion Hotel, on Saturday, the 22nd inst. 110 covers were laid, and amongst those present were representatives of the Manchester and Rawtenstall electricity departments and leading electrical manufacturers in the city. The chief electrical engineer of the company, Mr. W. Cotsworth, presided, and he was supported by Mr. C. Roberts, director. Apologies for non-attendance were read from Messrs. S. L. Pearce (Manchester Corporation), C. D. Taite (Lancashire Electric Power Co.), R. Blackmore (Stalybridge Corporation), and others. After dinner an enjoyable vocal and instrumental concert followed. Madame Ethel Nicholson gave excellent renderings on the violin, Mr. J. Ridgway on the flute and piccolo, and there were many humorous songs by members of the staff, together with some amusing lightning sketches. The chairman, Mr. W. Cotsworth, proposed "Success and Prosperity to the Calico Printers' Association," to which Mr. Roberts responded. Mr. F. H. Whysall, Manchester Corporation electricity department, as representing the guests, proposed "The Chairman." Not the least interesting of the speeches during the evening was an account of how electric lighting was first introduced into one of the company's works 34 years ago. The dynamo was driven by an engine nearly 90 years old. A pleasant evening ended by the singing of "Auld Lang Syne" and the National Anthem.

Institution Notes.—The Post Office Telegraph and Telephone Society of London.—At the second meeting of the session an address was given by Mr. John Newlands, C.I.E., Controller of the Central Telegraph Office, on "The Telegraph System, Methods and Results."

The Wireless Society of London.—Nearly 100 members attended a most successful general meeting of the above society, held in the Westminster City School on Tuesday evening last. The minutes of the inaugural meeting having been approved, the president (Mr. Campbell Swinton) commented on the rapid growth of the society, the membership of which had risen from seven on July 5th, to 60 on September 23rd, and to 160 at present; many country applications were still pouring in. They had a list of vice-presidents of which any society might be proud. The club rooms at 107, Hatton Garden, E.C., were now available for use though not completed. Ultimately a fine "wireless" library would be established, classes and demonstrations of new systems and apparatus would be arranged, and an elaborate set of apparatus was being installed such as would enable members to calibrate their own instruments and perform other work, generally beyond their reach, owing to lack of suitable apparatus. Discussing the question of licensing amateurs' stations, the president said that the Post Office was now experiencing great difficulty in allocating ranges and wave lengths in such manner as to avoid confusion. Coastal and shipping traffic must be protected against interference, and any amateur might be sure that if the range-circle of his proposed station included a State or commercial station or a shipping route, his application would be questioned very closely. Control over senders was imperative and secrecy must be respected, hence only responsible persons should be granted even receiving licences. The proposed tax on wireless licences was, however, indefensible if not actually contrary to the Act of 1904. Such an imposition would lead to evasion, for time signals could be received by apparatus which a search warrant would fail to reveal! The authorities ved help of *bona-*

fide amateurs, and members must see that present concessions were not abused; cases of "wireless hooliganism" (*e.g.*, false S.O.S. signals) must be dealt with severely. The Admiralty and Messrs. Marconi trained large numbers of operators using sending and receiving stations closely adjacent; there were no advantages but many objections to having instructional stations miles apart. Full membership of the society was now restricted to persons who had been engaged in wireless research or experimental work for at least two years *and/or* who satisfied the Committee that they possessed the necessary qualifications or training. The authorities were prepared to accept the endorsement of the society on applications for licences. Maps would be prepared for metropolitan and country areas, showing the location of members' stations; the work of the society would thus be facilitated.

Mr. Russell Clarke said it was proposed to have first-class standardised apparatus in the Society's laboratory, and about £70 worth of apparatus had already been promised by members, but, to avoid the ignominy and risk of living on charity, to realise the full possibilities of the Society and to make it self-supporting and flourishing, the original subscription must be raised to £1 1s. for metropolitan members and Associate members; 10s. 6d. for country and foreign members; and 10s. 6d. entrance fee. Those members who had already "got in on the cheap" might well bring their subscriptions, in effect, up to the new level by donations to the instrument fund.

The rules of the Society, including the increased subscription rates, having been approved, the president called upon Dr. W. H. Eccles to outline the research work initiated by the Radio-Telegraphic Committee of the British Association, and to indicate how members of the Society could help in this work.

Dr. Eccles said that the Committee recognised its duty to be the undertaking of work which could not be performed by individual experimenters. Discharges from the atmosphere in the immediate neighbourhood of a station (causing sparking in the aerial, or permitting a vacuum tube to be lighted, were called "statics" or "atmospherics." Disturbances arriving from a long distance were termed "strays," and the British Association had decided to investigate these natural electric waves, which travelled over a large part of the earth. About 70 per cent. of strays received at stations in the North and South of England could be traced and identified, but to trace them to their source—perhaps thousands of miles away—required a world-wide network of observers. Already the British Association was prepared to start work with 200 or 300 observers in British and foreign colonies, the United States, and ships in various seas. By the examination of records received, it was hoped to determine the laws and nature of "strays," and also (since the same set of observers would serve), to determine the influence of meteorological conditions on long-distance transmission. The Committee was preparing official forms, so that all information might be collected on a uniform plan; specimen copies of this form would soon be available to members, but, for the present, the Committee could only accept official assistance from, say, a dozen members of the Society scattered up and down the country. There were, however, many unofficials ways in which members could be of immense assistance to the Committee. For example, any member possessing a directional aerial should observe the direction from which disturbance proceeds during X-storms. There was much to be done, too, in the way of recording sunset and sunrise variations in the strength of signals received from, say, Coltano. Hitherto the difficulty had been to measure strengths of signals, but accuracy could be gained by practice, and the calibrating laboratory of the Society would doubtless prove invaluable. Two members working simultaneously on long and short aerials, or on two differently-tuned receiving sets in the same aerial, should record the frequency and strength of strays received; these would not be the same in each case. If members would work along these and similar lines, and if a sub-committee of the Society would sift reports before transmitting them to the B.A. Committee, the latter would be helped enormously, and this country would become the centre of such research.

Following the announcement of various gifts, a further appeal was made for money and apparatus, and the President announced that he would deliver an address at the next general meeting, in January, 1914.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Hereford T.C. has appointed MR. R. J. WRIGHT as charge engineer at the electricity works, vice Mr. W. Haines, who has received an appointment on the Margerita Tea Plantation at Makum, Assam.

MR. J. J. MCGREGOR, at present assistant engineer at the Deptford generating station of the London Electric Supply Corporation, is recommended for the position of charge shift engineer at the Greenwich generating station of the L.C.C., recently advertised. The advertisement stipulated for candidates to be "not more than 40 years of age," and there were 104 applicants. The salary is £250, rising to £300.

MR. C. FURNESS, the electrical engineer and tramways manager at Blackpool, has been elected president of the Blackpool and District Municipal Officers' Guild. The Blackpool Tramways and Electricity Committee has recommended that his salary be increased by £200 per annum. If the recommendation is adopted, Mr. Furness's salary will be £900 per year, the amount being divided proportionately between the electricity, the tramway, and the street lighting departments.

MR. J. S. GIBSON, charge engineer at the Dewsbury Corporation electricity works, has resigned his position.

MR. C. F. ANDERSON has resigned his position at the West Bromwich Corporation electricity works, having obtained an appointment with the Barnes (London) Urban District Council. The West Bromwich staff presented him with a gold matchbox.

Tramway Officials.—MR. WALTER T. YOUNG, who for two years has been traffic superintendent of the Oldham Corporation Tramways, has just been appointed to a similar position under the West Ham Corporation. Before going to Oldham, Mr. Young served under the Aberdeen Corporation for 14 years.

General.—We are informed that MR. J. H. COLLINGS, who for many years has been connected with the electrical fittings department of the General Electric Co., Ltd., at their head office, 67, Queen Victoria Street, London, E.C., has been appointed by the board of directors to the important position of manager of sales counters and showrooms at the Queen Victoria Street premises. During Mr. Collings's lengthy service with the company in the fittings department, we have had many opportunities of meeting with him, and from experience we can say that callers at the G.E. head office will always find him ready and willing to devote personal attention to their requirements.

An interesting presentation of a gold watch and chain has been made to MR. N. W. PRANGNELL, of the Metropolitan Electric Supply Co., by the Electric Supply Publicity Committee, as a token of their appreciation of his management on their behalf of La Maison Electrique, at the Ideal Home Exhibition, Olympia.

The marriage took place at the Parish Church, Waenfawr, on November 19th, of MR. HAROLD B. F. CHILDS, chief engineer of the Cefndu Marconi station, and Miss Enid Mary Williams, only daughter of the Rev. R. A. Williams. The presents included one from Mr. Marconi, and another from the engineering staff and workmen at the Cefndu wireless station.

MR. G. H. ANGER, managing director of the Anger Manufacturing and Supply Co., Ltd., Preston, has just returned from attending the Convention of the American Electric Railway Manufacturers' Association held at Atlantic City, and from a visit to the United States and Canada in the interest of his brake adjuster.

MR. S. M. JOHNSTONE having been appointed chief engineer and designer to a large crude rubber-treating machinery manufacturing firm, has resigned his position as engineer-in-charge with the St. Pancras Borough Council electricity department.

MR. STEVENSON has been re-elected Convener of the Edinburgh Corporation Electricity Committee.

COUNCILLOR GIBB has been unanimously re-elected Convener of the Aberdeen Corporation Electricity Committee, while COUNCILLOR SMITH has been appointed Convener of the Tramways Committee.

At the first meeting of the Sheffield Electric Light Committee, ALDERMAN C. F. BENNETT was elected chairman, in succession to Councillor J. W. Crowther.

Obituary.—MR. J. E. LICKFOLD.—It is with profound regret, we might say with the feelings of a personal loss, that we learn that Mr. J. E. Lickfold, the well-known solicitor, passed away on Monday morning last at the age of 73 years. He had been in ill-health for some time, but, as he showed some signs of improvement he was brought home from Ramsgate to his house at Muswell Hill ten days ago. Unfortunately, he became worse, and on Friday last the case was seen to be hopeless. The deceased gentleman stood quite in the front rank among City solicitors, for he had an experience of so varied and lengthy a nature as to be described as almost unique. Our own earliest association with him as proprietors and editors of the ELECTRICAL REVIEW, dates back now 21 years ago when, as representing the famous firm of Lewis and Lewis, of Ely Place, he devoted himself with all his heart and mind to the series of legal proceedings in which we were engaged consequent upon our exposures of the electric belt frauds. Thanks to his skill in handling matters, and to the justice of our cause, we were able to emerge from those proceedings satisfactorily. Some 16 years ago Mr. Lickfold left his old firm and commenced business on his own account, and two of his sons joined him later under the firm title of J. E. Lickfold & Sons. To these gentlemen and the other members of the family we tender our condolences in their bereavement.

SIR W. H. BAILEY.—The engineering world has lost one of its leading engineers, and Manchester one of its foremost public men, by the death, which we regret to announce, of Sir Wm. Henry Bailey. To engineers everywhere the name of his firm—W. H. Bailey & Co., Ltd., of Albion Works, Salford—is a household word. Present-day Manchester owes him much, among the valued services which marked his connection with that city being his interest in the Manchester Ship Canal, which brought such strength and activity into the industrial life of the borough and the surrounding district. Of this undertaking he was one of the original promoters, and it was when he was Mayor of Salford, in 1894, that Queen Victoria conferred upon him the honour of knighthood, the ceremony taking place on board the first vessel to pass through the Canal. He began inventing engineering apparatus when he was a very young man, and in the course of his career produced many inventions in connection with pumping, blast furnaces, mining, pyrometry, testing, and other machinery and instruments. One of the latest movements in which he displayed interest was the formation of the Engineers' Club at Manchester, the opening of which took place a week or two ago. Sir William passed away suddenly at a London hotel last Saturday morning. He was 75 years of age.

Mr. James Howden.—We regret to learn of the death, which occurred on November 21st, of Mr. James Howden, J.P., M.Inst.C.E., chairman of the well-known Glasgow engineering firm of James Howden & Co., Ltd. The deceased gentleman was 82 years of age.

Will.—According to a financial paper, the late Dr. Hermann Aron left estate in the United Kingdom valued at £7,755, the net personalty being £7,722.

NEW COMPANIES REGISTERED.

Musolaphone Syndicate, Ltd. (132,255).—This company was registered on November 19th, with a capital of £5,000 in £1 shares, to establish systems by means of which performances, entertainments, lectures, sermons, legal proceedings, orations, descriptions of athletic and sporting events, recitals of news, &c., may be transmitted to and received at distant places, by aid of telephones and telegraphic apparatus, to enter into contracts with the Government of this or any other country, &c. The subscribers (with one share each) are:—J. A. Nicholson, 31, Barrington Road, Egremont, Cheshire, clerk; A. E. Birch, 14, Elstree Road, Fairfield, Liverpool, clerk. Private company. Table "A" mainly applies. Registered by C. H. Wright, 24, Clement's Lane, E.C.

Indian Railless Traction Co., Ltd. (132,231).—This company was registered on November 18th, with a capital of £5,250 in 5,000 preferred shares of £1 each, and 5,000 ordinary shares of 1s. each, to carry on in India or elsewhere the business of engineers, electricians, suppliers of electricity for light, heat, power and traction, manufacturers of carriages, wagons, carts and other vehicles, &c. The subscribers (with one share each) are:—Sir Alick D. Gibbons, Bart., West Cliff, Isle of Wight; H. H. Bathurst, Finsbury Pavement House, E.C., secretary. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; remuneration as fixed by the company. Solicitor, L. M. Parkin, 114a, Chancery Lane, W.C. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

Dickinson Electrical Manufacturing Co., Ltd. (132,225).—This company was registered on November 18th, with a capital of £2,000 in £1 shares, to carry on the business of engineers, manufacturers and patentees of electrical and other appliances, &c., and to adopt an agreement with W. Dickinson. The subscribers (with one share each) are: G. North, Oaklands Road, Bexley Heath, Kent, electrical engineer; W. Dickinson, Highfield, Bexley Heath, Kent, electrical engineer; J. L. Orchard, Belvedere Road, Bexley Heath, Kent, electrical engineer. Private company. The number of directors is not to be less than two or more than five, the first are G. North (managing director), W. Dickinson and J. L. Orchard; qualification, £100; remuneration (except managing director) as fixed by the company. Registered office, 85, Broadway, Bexley Heath.

Wescoscope, Ltd. (132,240).—This company was registered on November 18th, with a capital of £7 500, in £1 shares (5,000 6 per cent. cumulative preference), to take over the business of electrical engineers and dealers in electrical appliances carried on by the Wright Electrical Sales Co., Ltd., at 5, Upper Mill Hill, and 94, Albion Street, Leeds, to carry on the same and the business of manufacturers of and dealers in photographic, magnetic, cinematographic, railway, motor and other appliances, &c., and to adopt two agreements—(1) with the said old company, and (2) with A. B. Hudson. The subscribers (with one share each) are:—W. W. Newbold, Street Lane, Roundhay, Leeds, merchant; A. B. Hudson, Hazelgrove, Thorner, near Leeds, engineer; A. M. Hudson, Hazelgrove, Thorner, near Leeds, engineer; A. Colby, 1, Nester Place, Leeds, tailor's assistant; G. R. Ellis, 14, Strathmore Drive, Leeds, tailor's cutter; W. C. Ellis, 14, Strathmore Drive, Leeds, tailor's assistant; W. Marchant, 39, Victoria Street, Chapel Allerton, Leeds, clerk. Minimum cash subscription 50 preference shares. The number of directors is not to be less than two or more than seven; the first are W. W. Newbould, A. B. Hudson and A. Hudson; qualification (except first directors), £250; remuneration of ordinary directors, £50 per annum. Solicitor, A. Pettitt, Leeds. Registered office, 94, Albion Street, Leeds.

Plates, Ltd. (132,280).—This company was registered on November 20th, with a capital of £6,000 in £1 shares (3,000 "A" and 3,000 "B"), to take over certain inventions, patents and rights relating to the processes or apparatus for the coating of plates and sheets, such as are used on the tinplate industry, to carry on the business of tinplate substitutes, smelters, refiners, rollers, assayers, &c., and to adopt an agreement with Metal Plates, Ltd., Sherard Osborn Cowper-Coles, and Peek, Frean & Co., Ltd. The subscribers (with one "A" share each) are:—A. Carr, 158, Drummond Road, S.E., director; G. Roberts, 158, Drummond Road, S.E., director; G. H. Davis, 158, Drummond Road, S.E., director; P. Carr, 158, Drummond Road, S.E., director; J. Carr, 158, Drummond Road, S.E., director. Private company. The number of directors is not to be less than two or more than four; the first are A. Carr, G. Roberts, S. O. Cowper-Coles, and J. Gordon Gordon. The two last named may remain directors for five years; qualification (except first directors), £100; remuneration as fixed by the company. Registered office, 158, Drummond Road, Bermondsey, S.E.

Electricals, Ltd. (132,317).—This company was registered on November 22nd with a capital of £10,000 in £1 shares, to carry on the business of electrical and mechanical engineers and contractors, electricians, suppliers of light, heat, sound and power, brassfounders, metal workers, boiler makers, manufacturers of and dealers in electrical and other machinery and plant, &c. The subscribers (with one share each) are:—J. G. Smith, Belmont, Bentinck Road, Newcastle-on-Tyne, accountant; W. R. Curry, 1, Curtis Road, Fenham, Newcastle-on-Tyne, clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification, 25 ordinary shares; remuneration as fixed by the company. Registered office, Cathedral Buildings, Dean Street, Newcastle-on-Tyne.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Pernambuco Tramways and Power Co., Ltd.—Amended particulars of £1,250,000 debentures, created July 24th, and secured by trust deed dated August 11th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £200,000. The original particulars gave the whole amount as issued.

Issue on November 14th, 1913 of £50,000 debentures, part of a series of which particulars have already been filed.

Aero Fire Alarm, Ltd.—Issue on November 13th, 1913, of £600 debs., part of a series of which particulars have already been filed.

Atlas Electrical Co., Ltd.—Particulars of £5,000 debentures, created August 14th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £350. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Greystones Electric Light and Power Co., Ltd.—Particulars of £1,200 debs., created by resolutions passed April 22nd, August 5th and October 28th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's undertaking, goodwill and all property, present and future. No trustees.

Rangoon Electric Tramway and Supply Co., Ltd.—Trust deed dated November 5th, 1913 (supplemental to trust deeds dated February 1st, 1906, and December 22nd, 1908, securing £250,000 debenture stock), charged on certain freehold and leasehold hereditaments and premises. Trustees: Sir John Gray Hill, Kt., 10, Water Street, Liverpool; and R. Henderson, St. Vincent Place, Glasgow.

Brilliant Arc Lamp and Engineering Co., Ltd.—Particulars of £300 debentures, created November 6th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Pirelli, Ltd. (103,068).—Capital, £8,000 in £5 shares; return dated October 2nd, 1913; all shares taken up; £8,000 paid; mortgages and charges: Nil.

Newton's, Ltd. (48,936).—Capital, £40,000 in £10 shares; return dated September 30th, 1913: 3,265 shares taken up; £18,650 paid; £14,000 considered as paid; mortgages and charges: £14,000.

Sheerness and District Electric Power and Traction Co., Ltd.—Particulars of £12,500 debs., created November 6th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £6,965. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Consolidated Diesel Engine Manufacturers, Ltd.

The directors have issued their report to March last (which will appear in our next issue). It shows that for the 19 months from March, 1912, to October, 1913, the general expenses exceeded the revenue by £9,600, and it is accompanied by a circular stating that the company is without sufficient funds to meet an expenditure of between £70,000 and £80,000 which is necessary for the purpose of running the Ipswich works until they can pay their way. A scheme is put forward for reconstructing the company with a view to putting it on a sound basis. A new company with £600,000 capital would take over the present company's undertakings, assets and liabilities, issuing 600,000 shares, each credited with 15s. paid up, the remaining 5s. liability being paid partly on application, partly on allotment, and the rest later. Shareholders would receive one share in the new company in exchange for each share held in the present company. A financial paper states that at the instance of shareholders representing over 200,000 shares, Sir W. B. Peat is making an independent investigation of the company's affairs.

Electrolytic Alkali Co.—At a meeting held on Monday, according to the *Financial Times*, shareholders approved of the scheme of reconstruction, involving the issue of 124,000 £1 7 per cent. participating preference shares. Existing preference shareholders will accept one new ordinary share for every five shares now held, and ordinary shareholders one for every 10. The total share capital will then amount to £164,000, compared with £300,000. It is proposed to extinguish the existing debentures, and to issue 60,000 new ones. £46,000 will be spent on the new power plant.

Adelaide Electric Supply Co, Ltd.—The directors have declared a final dividend of 5 per cent., making 10 per cent. for the year, together with a bonus of 2 per cent. on the ordinary shares for the year ended August 31st.

Japan.—An amalgamation has been arranged between the Kyushu Electric Light and Railway Co., the Sasebo Electric Co., the Karatsu Railway Co., the Nanyama Hydro-Electric Co., the Oiso Electric Co. and the Itoshima Electric Light Co. The amalgamated concern will be known as the Kyushu Electric Light and Railway Co.

Richard Hornsby & Sons, Ltd.—The directors recommend a dividend of 6¼ per cent. on the ordinary shares for the year ended September 30th. £15,000 is placed to reserve, and £4,570 is carried forward.

Melbourne Electric Supply Co., Ltd.—The directors announce a final dividend of 6 per cent., making 10 per cent. for the year, on the ordinary stock for the year ended August 31st.

Provincial Cinematograph Theatres, Ltd.—The directors have declared a second interim dividend of 7½ per cent. on the ordinary shares for the period ending October 31st.

Ruston, Proctor & Co., Ltd.—The directors announce an interim dividend at the rate of 5 per cent. on the ordinary shares for the half-year ended September 30th.

British Electric Traction Co., Ltd.—The directors have declared a dividend on the 6 per cent. cumulative preference stock for the half-year ended September 30th.

Provincial Tramways Co., Ltd.

The directors' report for the financial year ended September 30th, 1913, shows that the net revenue received from the local companies was £41,683, against £36,062 last year. The amount of net revenue from local companies was £41,683, plus £3,187 brought forward, transfer fees £35, interest £289, income-tax deducted from dividend warrants £1,405, making £46,600. From this there are deducted: Administration expenses, £1,511; income-tax, £1,467; Western Trust, Ltd. (trustee fee), £52; interest to the debenture-holders for the year, £8,750; preference dividend for the year, £6,000; interim dividend on ordinary shares, £4,152 = £21,932, leaving £24,668. The directors have set aside to credit of reserve and depreciation account £12,000, and for third party insurance or other purposes £2,000, leaving a balance of £10,668. The directors recommend a dividend upon the £1 ordinary shares of 1s. per share, making, with 8d. per share paid in June last, 1s. 8d. per share, a dividend of 8⅓ per cent. per annum for the financial year ending September 30th, 1913. The balance dividend upon the ordinary shares will absorb £6,228, and leave £4,440 to be carried forward.

The annual meeting was held on Friday last at the offices, Moorgate Station Chambers, E.C., Mr. Andrew Beattie, D.L., J.P., presiding.

The Chairman said that the accounts showed a prosperous state of affairs, the net profit being £41,683, against £36,062 in 1912, an increase of £5,631. That was highly satisfactory, as it was the largest net profit since the formation of the company. The results of the past year's working proved the forecast expressed at the last meeting to have been well founded. They had had extremely fine weather during the year, which had helped the receipts very considerably. The price of coal remained high during the year, and the cost of oil fuel used in their Diesel engines had been practically double. They had hoped that more favourable prices would have obtained towards the close of the year, but those hopes were not realised. In addition, in common with many other companies, increases in wages were demanded by their staffs in districts where wages had been generally increased, and the directors having carefully considered all the circumstances and the merits of the demands, conceded what they considered just and equitable. Those increases were found to be satisfactory to the employés. Speaking generally, there had been increases in nearly every department of the expenditure. Every year seemed to bring fresh demands, so that the strictest economy must be exercised in all these matters which the directors could control if they were to present a satisfactory balance-sheet. He would like to make it clear that efficiency in all departments had their first thought and attention, and the various undertakings stood in a high state of efficiency. They believed that their system of working was one of the most economical in the running and timing of cars so as to prevent duplication. During the past year they had had granted them an extension of their lease at Stonehouse, which was a part of their Plymouth, Stonehouse and Devonport system. They had now a 25 years' lease there, and although they had to pay an increased price for wayleave, they believed it to be quite satisfactory. Negotiations were at present going on for an extension of leases in other places, and they hoped to be able to report satisfactory results at the next meeting. The permanent way and rolling stock had been kept in a high state of efficiency, and new machinery and an electric battery had been added to their plant at Grimsby, at a cost of £2,193, to enable them to deal efficiently with the increased business. Last year the shareholders passed a resolution giving the board power to run motor-omnibuses, cars, char-à-banc and other mechanically-propelled vehicles, either in connection with the tramways or otherwise. During the past year they had taken advantage of that resolution with good results. Not only had these vehicles increased their profits, but they had warded off competition from their tramways. They hoped to continue that new method of passenger traffic in the future. After briefly referring to the accounts,

The Chairman moved the adoption of the report.

Mr. S. Hern, in seconding the motion, said that while congratulating the shareholders upon the excellent results, they must not be disappointed if next year did not prove to be quite so good, for as the chairman had told them they had this year been favoured with exceptionally fine weather.

Col. Bause, as an old shareholder, congratulated the directors on the position of the company. With regard to the £2,000 set aside for third-party insurance, he would like to know whether the directors had had any experience of acting as their own insurers.

Mr. J. Barbee Glenn, the secretary, said that that was the first time the company had set aside money for third-party insurance. He might say that it had been the practice of the company and also of the Isle of Thanet Co., with which he was connected, to insure in an office, and of course the payments were very considerable. In the Isle of Thanet Co. at one time it was a very disastrous transaction for the insurance company; the Provincial Tramways had always been a very good risk, but as they could well understand, accidents were always a very uncertain factor, and the last people that insured them at Gosport had not paid a single 6d. during the year until within a fortnight of the end of the 12 months, when a control wire got adrift and injured a young woman, who recovered £550 damages and £170 costs. The directors had made a start towards insuring their own risks by setting aside £2,000. They were insured with an office up till next September, and possibly, when they had got the fund up to £4,000 or £5,000, they might, he thought, safely do their own insurance altogether. It was, however, entirely a question of policy.

The report was then adopted.

Subsequently a resolution was passed increasing the directors' fees from £200 to £300 a year in the case of the ordinary directors, with an additional £100 to the chairman.

Barbados Electric Supply Corporation, Ltd.

The directors report that the results for the year ended June 30th, 1913, show a profit on operation of £395, as compared with a loss of £467 in the previous year. Considerable progress has been made during the year, but the results have been affected by the high cost of oil fuel which prevailed during the whole period. The directors' fees for the year, and the fees of the advisory committee in Barbados for the half-year to June 30th, 1913, although debited in the profit and loss account, have not been drawn. The total number of lamps and motors connected, of an equivalent of 25 c.p., was 9,430 at June 30th, 1913, which shows an increase of 4,020; and the number of consumers connected to the mains was 456, as compared with 247 at the close of the previous year. The number of consumers awaiting connection is encouraging. The growth of revenue has been steady, but the slow progress made was due to the small number of units consumed per lamp connected and to the low load factor. Negotiations are at present proceeding for the supply of power to the Tramway Co., which intends shortly to convert its line into electric traction, and, if these negotiations can be brought to a successful conclusion, the average cost of generation per unit will be materially reduced. This contract, if obtained, will necessitate further capital being raised to meet the expenditure on the plant which would require to be installed. The company is now supplying a portion of the public lighting at Bridgetown, and an additional contract has recently been obtained. A contract has also been obtained from the Government for lighting the wharves and inner basin. Capital expenditure during the year, amounting to £2,485, represents expenditure on extensions to mains for public lighting and general service, and for house connections with consumers. The general manager reports that the plant and distribution system are in satisfactory working order. The meeting is called for Monday next, at Basildon House, E.C.

Prospectuses.—*Portarlington Electric Light and Power Co., Ltd.*—A prospectus is in circulation offering for subscription 2,600 cumulative preference shares of £1 each in this company, which has been formed to supply electric light and power in Portarlington district. The works will be constructed by Messrs. Foote & Milne, Ltd. The Mountmellich and Cloneygowan Councils have given permission for the erection of overhead lines. It is proposed to install a semi-Diesel type of engine consuming crude oil, and a battery. Applications have been received for 800 lights. Messrs. Wilkins & Burden, of Dublin, are consulting engineers to the company, and the offices are at 66, Victoria Street, London, S.W. The list is to close on December 8th.

The British Electric Heater Co., Ltd.—As will be seen from our advertisement pages to-day, this company, which has a nominal capital of £50,000, is making an issue of 30,000 6 per cent. participating preference shares, of which 7,457 have already been allotted, leaving 22,543 of £1 each for subscription. The company has been formed to acquire the patents for an apparatus for heating water by electricity, invented by Mr. Charles Kratt, electrical engineer, Glasgow, and to manufacture and sell such heaters. The purchase price payable to the vendors, the K.P.H. Syndicate, Ltd., is £3,000 in cash, £20,000 in ordinary shares, and £17,500 in participating preference shares, or in cash, at the option of the company. A royalty of 1s. 6d. per towel rail sold is also payable by the company. The apparatus was described in our pages some years ago, and in its improved form in our issue of March 14th; it is undoubtedly ingenious and practical, but whether the demand for such apparatus will justify so large an issue and so high a price, to say nothing of a royalty in addition, may be open to question.

Continental.—Germany.—With the view of providing the necessary funds for the development of several of its subsidiary undertakings, the Elektricitäts Gesellschaft (W. Lahmeyer & Co.), of Frankfort-am-Main, is increasing its capital from £1,250,000 to £1,500,000.

Under the auspices of Messrs. Brown, Boveri & Co., of Baden, and the Rhenish Credit Bank, a new company has just been formed in Mannheim, with a capital of £150,000, and the title Die Elektrische Kraftversorgung Gesellschaft, to establish plants for the supply of electrical energy for power purposes.

Norway.—It is announced from Christiania that a company has just been formed, with a capital of £222,000, and the title "Det Norske Aktieselskap for Elektroteknisk Industrie," with the object of developing the electrical industry in the country by promoting new enterprises and assisting financially in the extension of those already in existence.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in:—

Stolz Electrophone Co. (1913), Ltd.—35,000 shares of £1 each, fully-paid, Nos. 1 to 35,000.

And to allow the following to be quoted in the Official List:—

Columbia Gas and Electric Co.—$50,000,000 capital stock in shares of $100 each.

STOCKS AND SHARES.

Tuesday Evening.

With the Money Market showing a tendency to become more accommodating to borrowers, the prices of investment stocks and shares are certainly disposed to improve; and although indications are not wanting that the festive season is near at hand, there is still a fair amount of business proceeding in Stock Exchange markets. Those especially favoured are concerned with Colonial stocks and Home Rails. The publication of various Parliamentary notices in connection with electric lighting schemes has had no effect upon prices up to the present.

One of the most interesting of these announcements is that of the County of London Electric Supply Co. A Bill is being promoted to enable the County of London Co., on behalf of itself and other electric lighting concerns, to come to an agreement with the L.C.C., with a view to extending the Council's time of purchase and generally to modify the present arrangements. This is the most significant step which has yet been taken in connection with the proposition to unite into one homogeneous body the various interests at present concerned in the supply of electric current to the Metropolis.

In the Stock Exchange, the proposal (tucked away, as it was, in the advertisement columns of the *Times*) attracted comparatively little attention. A few scattered references to it have been made in the daily Press, but the effect upon the share market has been just nil. In this there is cause for satisfaction, for, manifestly, the matter is not yet far enough advanced to justify any speculative purchases of electric lighting shares upon the basis of a Bill which is to be promoted, and which will not come before Parliament until next session. The importance of the step resides in its practical character; and, after these many years of strenuous work, the supporters of the scheme may be congratulated upon having brought it well within the range of practical politics.

The price changes on the week are unimportant. City "Lights" were put up ¼, to lose the fraction later, but the Preference rose ½, and held the improvement. London Electric Preference, Metropolitan Preference and South London Ordinary are better, although the rise in the last-named simply replaced the loss of last week. There is rather more inquiry for some of the Debenture stocks, and the disposition of the market, as a whole, is firm. Manifestly, proprietors are not likely to sell their shares with the prospect of agreement between the different undertakers in sight at last.

Home Railway stocks show pronounced strength. After being plunged into the depths of depression, there came substantial revival, the steam stocks advancing gaily. In the Underground group, the attention drawn here last week to London Electric Railways 4 per cent. Preference stock, considered as a speculative investment, led to a slight hardening of the price. Metropolitans and Districts are both features of strength; the price of the former went back to 39¾, but has since shot up to 43½. Districts put on 1¼. The London and Suburban issues remain depressed. London United Tramways Debenture is a point higher. The British Electric Traction group inclines to the duller side. Metropolitans owe their rise partly to "bear" covering, partly to the announcement that the Great Northern Railway proposes to establish a direct connection with the Great Northern and City Railway, which, of course, the Metropolitan now owns.

Telegraph stocks, taking the market all round, are dull and inactive. Investors are not showing much interest in the stocks at present, although the returns from Eastern Telegraph stock, Eastern Extension shares, Western Telegraphs and Globe Ordinary range from 5¼ to 5½ per cent. on the money. In all of these there is a tolerably free market. But no doubt there remains still in the public mind some slight fear less the wireless competition should damage the earnings of the older companies. Marconis went back sharply, the price getting down to $3\frac{5}{16}$, but they improved again to $3\frac{6}{16}$ as the approach of the Stock Exchange settlement drove bears to buy back. The announcement that a telephone message was sent from a German port across the Atlantic, and that the words were heard distinctly, was noticed with a good deal of interest in the Stock Exchange, while its denial caused no particular surprise. Stock Exchange arbitrage business, by the way, between London and Paris, does not appear to have been greatly stimulated by the reduction in the cost of telephoning between the two centres, which is now, of course, 4s. for three minutes, instead of 8s.

Mackay Common and Preferred are flat, and American Telephone issues have receded. On the other hand, rises occurred in Anglo-American Telegraph Deferred and Direct United States Cable shares, while West India and Panama gained a small fraction.

News from Mexico is still of a very mixed character, and the Stock Exchange hardly knows what to make of the position out there. Some of the smart recoveries which occurred in the utility companies' issues have been partially lost; for example, Mexico Tramways Common went back 1½, although the 6 per cent. bonds are a point up. Mexican Light and Power Common fell 2, while the Preferred gained a similar amount. The recovery in Monterey bonds has been held; yet, on the other hand, Pachuca Fives fell 3 points to 72½. Canadian General Common and Shawinigan Water Capital stock have both hardened. The principal feature in this group, however, is a jump of 5½ points in Electric Supply of Victoria Debentures, which took the price to 94½. This was due to demand for sinking-fund purchases, and the dealers report that it failed to bring out much stock. The Anglo-Argentine division is steady, except for a decline of $\frac{1}{16}$ in the First Preference shares. City of Buenos Ayres Trams rose $\frac{1}{8}$ to $5\frac{5}{16}$.

Willans & Robinson Preferred stock, after its rise of 4 points last week, has risen another 7, the stock now standing at 21½, while the Debenture is a point to the good. There has been further buying of British Westinghouse Preference, and with few shares about, it did not take much to raise the quotation ⅛. Castner-Kellner's eased $\frac{1}{16}$ after the announcement of the dividend and share bonus; and British Aluminium Ordinary shaded off to $1\frac{5}{32}$.

The Rubber market shows hesitancy after being good. Apparently there is a good deal of the "pull devil, pull baker" business going on in connection with the raw rubber market, some maintaining that the price ought to be taken up to 3s. 6d. per lb. as quickly as possible, while others think that its retention at something between a florin and half-a-crown, for the time being, would be more desirable in the interests of the industry as a whole. Meanwhile, share prices are as a rule better, with people putting a fair amount of money into the market. Large blocks will be lifted at this week's Stock Exchange account. But the produce is lower at 2s. 3½d. per lb., and this disappoints the optimists.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, November 26th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	"	22/-	..
a " Oxalic	per lb.	3d.	..
a " Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	"	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£33 10	..
a Bleaching powder	"	£6 5	..
a Bisulphide of Carbon	"	£18	..
a Borax	"	£17 10	..
a Copper Sulphate	"	£24	..
a Lead, Nitrate	"	£30	..
a " White Sugar	"	£28	..
a " Peroxide	"	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a " Chlorate	per lb.	3½d.	..
a " Perchlorate	"	4½d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	"	7½d.	..
a Shellac	per cwt.	92/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	"	£8 10	..
a " Recovered	"	£5 10	..
a " Lump	"	£5	..
a Soda, Caustic (white 70/72 %) ..	"	£10 5	..
a " Chlorate	per lb.	3½d.	..
a " Crystals	per ton	£8 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£96	..
b " Wire, in ton lots (1 to 14 S.W.G.)	"	£151 6 8	..
b " Sheet, in ton lots ..	"	£126	..
p Babbitt's metal ingots	"	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅞d.	½d. dec.
c " Tube (brazed)	"	9½d.	½d. dec.
c " " (solid drawn) ..	"	8⅝d.	½d. dec.
c " Wire, basis	"	7⅞d.	½d. dec.
c Copper Tubes (brazed)	"	10⅝d.	½d. dec.
c " " (solid drawn) ..	"	10⅝d.	½d. dec.
g " Bars (best selected) ..	per ton	£83	£3 dec.
g " Sheet	"	£83	£3 dec.
g " Rod	"	£83	£3 dec.
d " (Electrolytic) Bars ..	"	£69 10	£4 10 dec.
d " " Sheets ..	"	£87 10	£4 10 dec.
d " " Rods ..	"	£75	£4 10 dec.
d " " H.C. Wire	per lb.	9¾d.	½d. dec.
f Ebonite Rod	"	4/6	..
f " Sheet	"	4/-	..
n German Silver Wire	"	1/10	..
h Gutta-percha, fine	"	7/6	..
h India-rubber, Para fine	"	3/1	3d. dec.
l Iron Pig (Cleveland warrants) ..	per ton	49/3	4d. dec.
l " Wire, galv. No. 8, F.O. qual.	"	£14	..
g Lead, English Pig	"	£18 15 to £19	£1 10 dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bott.	£7 10	5/- inc.
e Mica (in original cases) small ..	per lb.	6d. to 3s.	..
e " " " medium	"	3/6 to 6/-	..
e " " " large ..	"	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	"	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	"	1/1 to 1/3½	..
p " " rolled bars & rods	"	1/0½ to 1/3	..
p " " rolled strip & sheet	"	1/3½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	"	£182 to £183	£1 dec.
n " Wire, Nos. 1 to 16	per lb.	2/6	..
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	£25 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n F. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. P. Dennis & Co.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Nov. 25th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	6	5†	9⅛ — 10⅛	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 10
Brompton & Kensington, Ord.	5	10	9†	8⅜ — 8⅞	— ⅛	5 12 8
Do. 7 % Cum. Pref.	5	7	7	8⅜ — 8⅝	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	93 — 96	..	4 3 4
Charing Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅛	..	5 9 1
Do. Do. 4 % Deb.	100	4	4	90½ — 92½	+ ½	4 6 6
Chelsea, Ord.	5	5	4†	4⅝ — 5	..	5 0 0
Do. ½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	16 — 17	..	5 6 0
Do. 6 % Cum. Pref.	10	6	6	13 — 14	+ ½	4 5 9
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 3 4
Do. 4½ % Second Deb.	100	4½	4½	99 — 101	..	4 9 1
County of London, Ord.	10	6	5†	11⅛ — 12	..	5 0 0
Do. 6 % Pref.	10	6	6	11⅛ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	102½ — 104½	..	4 6 2
Do. 4½ % Second Deb.	Stock	4½	4½	97 — 100	..	4 10 0
Edmundson's, Ord.	£3	..	..	1/16 — 1/8	— 1/16	Nil
Do. 6 % Cum. Pref.	5	6	6	5⅝ — 4½	— ⅛	7 1 2
Do. 6 % Non-Cum. Pref.	5	..	..	1⅛ — 1⅜	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4⅜ — 4⅝	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅝	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	9	8†	7⅞ — 8⅛	..	5 10 9
Kensington & Knightsbridge, Ord.	5	8	8†	7⅛ — 8	..	5 0 0
Do. 4 % Deb.	Stock	4	4	88 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	3	2½	..	1⅛ — 1⅜	..	4 12 7
Do. 6 % Pref.	5	6	6	4⅛ — 5¼	+ ⅛	5 14 9
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	4	4†	3⅛ — 3⅜	..	5 10 4
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	+ ⅛	4 12 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort Deb.	Stock	3½	3½	79 — 82	..	4 5 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 — 102	..	4 18 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 10⅜	..	5 11 7
Oxford	5	7	6†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord.	5	10	10†	8⅝ — 9⅛	..	5 8 1
Do. 7 % Pref	5	7	7	6⅝ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	83½ — 85½	..	4 1 10
South London, Ord.	4	5½	..	2⅝ — 3⅛	+ ⅛	7 0 8
Do. 5 % First Mort. Deb.	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref.	1	7	7	1 3/16 — 1 5/16	..	6 1 3
Do. 4½ % First Deb. Stock	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	1/16 — 1/8	..	..
Do. 5 % Cum Pref.	5	3	..	2⅛ — 2⅝	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86	..	5 4 8
Westminster, Ord.	5	10	10†	8⅜ — 8¾	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4¼ — 5⅛	..	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6†	4⅞ — 5⅛	..	5 17 1
Calcutta, Ord.	5	6⅛	6†	7⅛ — 7⅝	..	5 11 6
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com.	$100	7	7†	107 —112	+1	6 7 3
Do. 7 % Pref.	$100	7	7	118 —123	+1	5 14 9
Cordoba Lt., Power and T., Ord.	1	5	..	3/16 — 1/4	..	6 3 1
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93	+ ½	6 9 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	93 — 96	+5½	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	94½ — 96½	+1	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	7/16 — 7/8	..	Nil
Do. 6 % Pref.	1	6	6†	3/4 — 1	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	10½ —104½	..	4 15 8
Madras, Ord.	5	Nil	..	1¼ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.		5	5	68 — 73	+2	7 0 10
Mexican Lt. & Power, Common	$100	4	4	48 — 52	—2	7 8 2
Do. 7 % Cum. Pref.	$100	7	7	80 — 85	+2	8 9 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	78 — 83	..	6 0 6
Do. 5 % 2nd Mort. Bonds	100	5	5	68 — 73	..	6 17 0
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5*	5	55 — 62	..	8 1 4
Montreal, Lt., H. and Power	$100	9	10†	212 - 218	..	4 11 9
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	ta	15 — 25	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	99 - 104	..	5 15 5
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort Deb.	100	4½	4½	99 —101	..	4 9 4
Shawinigan Water, Capital	$100	5½	6†	132 —137	+1	4 7 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105 —107	..	4 18 6
Do. 4½ % Per. Deb.	Stock	4½	4½	97½ — 99½	— ½	4 9 6
Toronto Power, 4½ % Deb.	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	89 — 91	..	5 8 9
Victoria Falls Power, Pref.	1	6	6	3⅞ — 3⅞	— 1/16	6 12 6
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 8

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	..	6⅞ — 7⅛	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	122 —124	—1	6 9 0
Do. Collat. Trust	$100	4	4	88 — 91	—1	4 8 0
Anglo-American Telegraph	Stock	3	3	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	104½—105½	..	5 13 9
Do. Def.	Do.	30/-	..	22⅜ — 24⅜	+ ⅜	6 3 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	..	7 7/16 — 7 9/16	..	5 5 7
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	79 — 81	..	4 18 9
Cuba Telegraph	10	6	6†	8⅜ — 9⅜	..	6 9 9
Do. 10 % Pref.	10	10	10	14½ — 15½	..	6 11 2
Direct Spanish Telegraph, Ord.	5	4	4	8¼ — 8⅝	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6¾ — 7¼	..	6 12 0
Direct United States Cable	10	4	4†	6⅜ — 6⅝	+ ⅛	5 16 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	126 —129	..	5 8 6
Do. 8½ % Pref. Stock	Do.	8½	8½	75— 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97 xd	..	4 2 6
Eastern Extension	10	7	7	12⅛ — 12⅝	— ⅛	5 11 0
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust	10	6	6†	10⅞ — 11½	..	5 6 8
Do. 6 % Pref.	10	6	6	11⅝ — 12⅝	— ⅛	4 19 0
Great Northern Telegraph	10	20	5†	80½ — 82½	..	6 2 8
Indo European Telegraph	25	13	5†	57 — 59	..	5 10 2
Mackay Companies Common	$100	5	5	78 — 82	—3½	6 2 0
Do. 4 % Cum. Pref.	$100	4	4	64 — 68	—2½	5 17 8
Marconi's Wireless Telegraph	1	20	..	3⅛ — 3⅜	+ ⅛	5 10 2
Do. 7 % Cum. Partic. Pref.	1	17	..	2⅜ — 2⅝	+ 1/16	5 18 3
Monte Video Telephone, Ord.	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	1⅛ — 1⅜	..	6 3 1
New York Telep., 4½% Gen. Bnds.	100	4½	4½	96⅜ — 97⅜	..	4 12 1
Oriental Telep. and Elec.	1	10	10†	1⅞ — 2	..	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97 — 99	..	4 1 0
Reuter's	10	10	10†	8¾ — 9½	..	10 10 6
Submarine Cables Trust	Cert.	6	6	122½ —125½	..	4 15 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 11
United River Plate Telephone	5	8	6†	6¼ — 6⅝	..	5 1 6
Do. 5 % Cum. Pref.	5	5	5	5 — 5⅛	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 5/16	..	4 3 4
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1¼	..	2¼ — 2½	+ 1/16	5 0 0
Do. 6 % Cum. 1st Pref.	10	6	6	9½ — 10	..	6 0 0
Do. 6 % Cum. 2nd Pref.	10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	98 —100	..	5 0 0
Western Telegraph, Ltd.	10	7†	7	12⅜ — 13⅛	..	5 5 8
Do. 4 % Debs.	Stock	4	4	94 — 96	..	4 3 4
Western Union 4½ % Fdg. Bonds	$10.0	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated, all shares are fully paid. Paid in deferred interest warrants. † Interim Dividend. 3s. in Funded Dividend Certs.

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 25th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	⅛ — ¼	..	Nil
Do. 5 % Pref.	1	5	5	8⅝ — 8¾	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	10 — 12	— ½	..
Do. Do. Deferred	100	..	..	3½ — 5½	..	..
Do, Do. 6 % Cum. Pr'f.	100	6	6	87 — 90	..	6 13 4
Do. 7 % Non-Cum. Pr'f.	100	8	..	48 — 51	..	5 17 8
Do. 5 % Perp. Deb.	100	5	5	90 — 93	..	5 7 6
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80	+2	5 12 6
Central London Railway, Ord.	100	3	3	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 8
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	77 — 79	..	5 1 3
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1908	100	5	5	95 — 97	..	5 3 1
Do. 4 % Deb.	100	4	4	89 — 91	..	4 8 0
Hastings Trams, 6 % Pref.	1	6	6†	⅜ — ½	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2 7/16 — 2 9/16	..	4 17 7
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	77 — 81	..	6 3 5
London and Suburban, Ord.	1	..	..	⅝ — ¾	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅜ — ½	..	..
Do. Do. 4½ % 1st Deb.	100	4½	4½	74 — 79	..	5 14 0

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 25th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	58 — 62	+1	6 11 2
Metropolitan Railway Consol.	100	1⅝	1½†	43 — 43½	+2½	3 14 9
Do. Surplus Lands	100	2⅜	2⅜†	58 — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan District Ord.	100	Nil	..	29½ — 30½	+1½	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5
Do. 4 % Prior Lien	100	4	4	93 — 95	..	4 4 8
Do. 4½ % First Pref.	100	4½	4½	81 — 83	..	5 8 6
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	⅛ — ¼	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	80 — 83	..	5 8 3
South Metro. Trams, 6 % Pref.	1	6	6†	⅜ — ½	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	8½ — 8⅝	..	Nil
Do. "A"	1/-	..	..	1/16 — 1/8	— 1/16	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	111 —113	..	5 6 2
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	89 — 90	..	6 13 4
Yorkshire (West Riding). Ord.	5	Nil	..	⅛ — ⅜	..	Nil
Do. 6 % Pref.	5	3	1½†	3¾ — 4	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 86	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo Arg. Trams, 1st Pref.	5	5½	5½	4 7/16 — 4 11/16	..	5 14 8
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 7/16	..	6 3 11
Do. 4 % Deb.	100	4	4	89½ — 91½	..	4 7 5
Do. 4½ % Deb.	100	4½	4½	97½ — 99½	..	4 10 6
Do 5 % Deb.	100	5	5	98½ —100½	..	4 19 6
Auckland Trams, 5 % Deb.	100	5	5	101 —104	..	4 17 1
Bombay Elec. S. & Trams, Pref.	10	6	6	10½ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	97 —100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	86 — 88	— ½	6 16 4
Brisbane Trams Invt., Ord.	5	8	8	7½ — 7¾	..	5 3 8
Do. 5 % Pref.	5	5	5	4 7/16 — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	114 —119	..	6 14 6
Do. Pref. Ord.	100	6	6	101 —106	—1	5 18 2
Do. 5 % Pref.	100	5	5	100 —103	+ ½	4 17 0
Do. 4½ % 1st Mort. Deb.	40	4½	4½	97 —100	..	4 10 0
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	92 — 95	..	4 9 6
Calcutta Trams, Ord.	5	7½	5†	5⅛ — 6⅜	..	5 17 8
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	3¼ — 3⅜	..	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5 3/16 — 5 5/16	..	4 12 0
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5% A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	..

La Plata Elec. Trams, Ord.	1	..	..	⅜ — ½	..	..
Do. Pref.	1	4½d.	6	¾ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1 — 1½ xd	..	4 16 1
Do. 6 % Pref.	1	6	6	1⅛ — 1⅜	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 3
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4½ — 5⅛	..	5 17 1
„ Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	85 — 87	..	5 15 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	76 — 79	—1½	8 17 2
Do. Gen. Con. 5 % Bonds	..	5	5	80 — 85	..	6 17 8
Do. 6 % Bonds	100	6	6	82 — 85	+1	7 1 2
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5⅞ — 6⅛	..	8 0 0
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 12 1
Do. 5 % 1st Deb.	100	5	5	94½ — 96½ xd	..	5 3 8
Perth (W.A.) Elec. Tr., Ord.	1	5⅛	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅝	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	98½ —100½	+ ½	4 19 6
Do. 5 % Mort. Bonds	100	5	5	88 — 90	..	5 11 1
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	99 —102	..	4 18 0
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4⅞ — 5⅛	..	6 13 4
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 14 8
Do. 5 % 1st Deb.	100	5	5	93½ — 96½	..	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	—2½	4 13 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	⅜ — ½	..	8 12 4
Do. 6 % Pref.	1	6	6	3/16 — 5/16	..	7 18 4
Babcock & Wilcox	1	16	..	2⅜ — 3	..	5 6 8
Do. Pref.	1	6	6	1 7/16 — 1 9/16	..	4 3 6
British Aluminium, Ord.	1	..	..	1 3/16 — 1 5/16	— 1/32	..
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1⅜	..	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85 — 87	— ½	5 15 0
B.I. & Helsby Cables	5	10	..	8 — 8½	..	5 17 8
Do. Pref.	5	6	6	5⅜ — 6¼	— ¼	4 16 0
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	8	Nil	..	1⅛ — 1⅜	+ ⅛	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 76½	..	6 12 5
Do. 4½ % Deb.	100	4½	4½	35½ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	6†	10½ — 11½	..	6 10 5
Do. Pref.	5	5	5	5 — 6¼	..	4 15 8
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	22½	3 1/16 — 3 1/16	— 1/16	5 14 8
Do. Deb.	100	4½	4½	102 —105	..	4 5 9

Crompton & Co., Deb.	100	5	5	64 — 69	..	7 5 0
Dick, Kerr	1	Nil	..	⅛ — ¼	..	..
Do. Pref.	1	6	6	3/16 — 5/16	..	7 2 2
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1⅛ — 1⅜	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	⅜ — ½	..	7 5 6
Do. Pref.	1	7	7	1⅛ — 1 3/16	..	6 11 9
Greenwood & Batley, Pref.	10	7	7	6½ — 7½	..	9 13 3
Do. Deb.	100	5	..	92 — 94	..	5 4 2
General Electric, 6 % Pref.	10	6	6	9⅞ — 10⅜	..	5 15 8
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	10†	12⅜ — 13½	..	5 11 1
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16	..	4 8 11
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	5	13 — 14	..	5 7 2
Do. Pref.	10	5	5	9½ — 10	..	5 0 0
Telegraph Construction	12	20	5†	37 — 39	..	6 8 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	56 — 61	..	6 11 2
Do. B 4 % Cum. Pref.	100	..	..	19 — 24	+7	..

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 2nd, 1913.

THE ELECTRICAL EXHIBITS AT THE OLYMPIA MOTOR-CAR EXHIBITION.

By CHAS. J. WEBB, A.I.A.E.

(*Continued from page* 848.)

The Scott.—Prominent among the new combined car electric lighting dynamos and engine starters is the "Scott," made by Scott's Starter Syndicate, Ltd., Norwich, to the designs of Mr. W. H. Scott, M.I.E.E., the technical managing director of Messrs. Laurence, Scott & Co., Ltd. In the first place, it may be mentioned that, in its new form, the machine considerably differs from the one described and illustrated in these columns about a year ago, in which, it may be remembered, a series-parallel system of electrical connections, with a differential winding for keeping the charging current constant with varying engine speeds was employed. It was found that certain disadvantages were entailed, *e.g.*, both complication of the wiring, and the difficulty of getting equal charging of cells when in parallel. It was, therefore, decided to construct the machine on the single-voltage system. With this system, it is explained that the

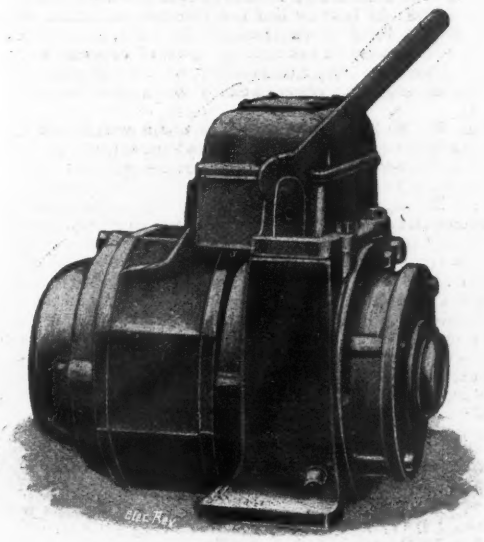


Fig. 8.—Scott Combined Lighting Dynamo and Engine Starter.

differential-winding method of regulation is not possible, unless a separate additional series-winding be employed for the charging. It is further contended that any differential winding system of regulation has the disadvantage that as the voltage of the battery increases the charging current increases, which is the opposite to what is desirable from the point of view of life of the cells. An automatic regulator in the shunt winding was, therefore, tried, and, after considerable experimenting, has, it is claimed, proved a success. The armature is of the standard slotted drum pattern; the field magnet windings are suitably proportioned so that the machine can act as an ordinary shunt dynamo when driven by the engine, and also as a powerful series-wound motor to drive the engine through an epicyclic gear which gives a speed reduction of 14 to 1, the latter, however, being capable of modification to suit the particular engine to which it is to be adapted.

As a motor the machine takes current at 24 volts, *i.e.*, using a battery of 12 cells, and as a dynamo the voltage is the same, but as the lighting circuit is arranged on the three-wire system, 12-volt lamps are used. An important advantage of the special field magnet proportions and armature windings is that the current at the instant of closing the circuit is comparatively low.

Perhaps the most interesting part of the starter is in connection with the gearing. Referring to the drawing, fig. 9, which is to be regarded as purely diagrammatic, in the planetary gearing shown, the armature shaft gears into the three planet wheels, which revolve on pins fixed to the disc-wheel; these three pinions gear into what is termed the engine wheel, which carries the sprocket wheel for connecting to the engine shaft. The disc-wheel, if free, will revolve in the opposite direction to the armature shaft, and no power will be transmitted to the engine wheel, but if the band brake is applied, the engine wheel will be driven in the same direction as the armature shaft; the leverage being, as before noted, usually of the ratio of 14 to 1. The band brake, however, can only prevent the rotation of the disc wheel in the one direction, because of the free wheel clutch shown; this being an essential feature of the starter. The starter can be operated or controlled in several ways, according to its position on the car; the usual way being by means of a pull handle in front of the driver, which first switches on the current to the starter, causing the armature to start freely. A further motion of this pull handle tightens the band brake on to the disc wheel of the planetary gearing, and the armature then drives the crankshaft through this gearing and the chain drive that is usually employed. The band brake, however, only holds in one direction, and as soon as the engine fires, the planetary gearing revolves as a whole, there being a free-wheel on the armature spindle which is free when the armature drives, but which locks the gearing when it is being driven. When the engine starts, the pull handle, which has a spring return, is let go, a spring catch being thereby pulled into the charging position, so that the driver is relieved of the task of remembering to put on the charging switch after starting.

The generation of current for charging the cells is done through the locked free-wheel already mentioned, the output as a dynamo

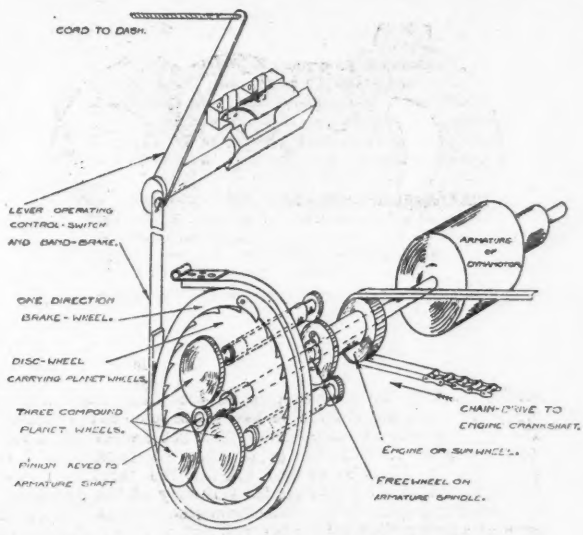


Fig. 9.—Scott Engine Starting Arrangement.

being controlled by an automatic resistance embodied in the switchboard. This device is actuated by a solenoid form of magnet and regulates the shunt current in the dynamo. Charging begins at 12 to 15 miles an hour, this depending on the gear ratio fitted. Provision is also made for disconnecting the dynamo from the battery when the latter is fully charged, and in the event of the circuit being left closed, when the engine is stopped, the armature is merely slowly revolved by the battery current. This, it is claimed, involves but little loss and is quickly noted by the slight click of the free-wheel. The machine is being made in three sizes, suitable for engines of low, medium and high power. The brushes are easily accessible by removing the end cover, and the epicyclic gear is enclosed in an oil-tight casing at the opposite end.

The U.S.L.—One of the most interesting combination car lighting dynamos and engine starters is that known as the U.S.L., made by the United States Light and Heating Co., of New York, which has been adopted on the Sheffield Simplex (British) cars. Differing from any of the machines so far described, the U.S.L. device is

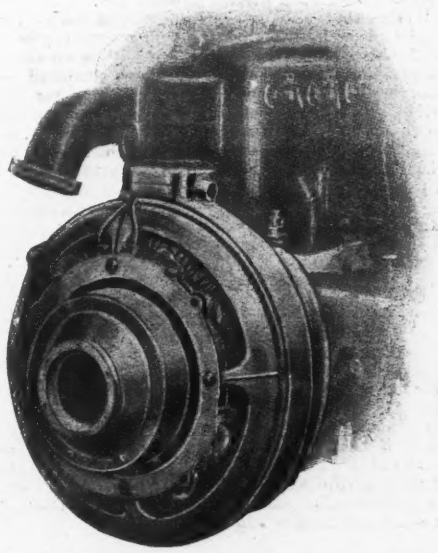


Fig. 10.—U.S.L. Lighting Dynamo and Engine Starter.

built up as an integral part of the engine of the car, the usual fly-wheel being replaced by an armature having the same weight

and inertia characteristics. Fig. 11 shows the motor-generator dismantled; on the left is the casing bolted to the engine crank case and carrying the field magnets. Next is the revolving armature, to which the clutch casing is bolted, and next to that a stationary ring carrying the brushes within which the commutator on the armature runs. On the right is a domed cover which envelops the whole. The machine has a compound field, series and shunt coils working cumulatively as a motor, and differentially as a generator. The combined ampere-turns of the shunt and series coils are sufficient to saturate the magnetic circuits, so that a high starting torque is claimed to be obtained. The only

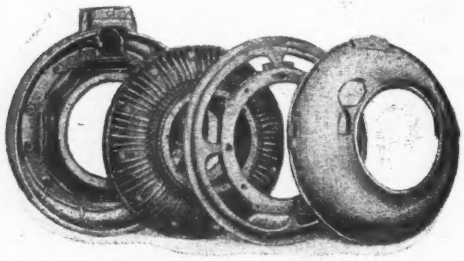


Fig. 11.—Component Parts of U.S.L. Starting and Lighting Device.

moving part is the armature, while the brush gear is of an ingenious form, and claimed to have a life equal to 32,000 miles. The starting current varies from 125 to 250 amperes at 24 volts. The torque is exerted at a distance of from 6 to 7 in., depending on the size of the engine, the turning moment being exerted at all points on the periphery of the fly-wheel, so that no extra pressure is thrown on the engine bearings. When running as a motor, the machine is capable of driving the engine at a speed of from 150 to 400 R.P.M., the makers furnishing instances of its use for starting a four-cylinder engine, 4 in. bore × 4½ in. stroke, at 350 R.P.M. on 50 amperes, and a terminal pressure of 22 volts, or approximately 3·15 watts per revolution, and another case of a 4½ in. × 5 in. four-cylinder engine, taking, at 280 revolutions, 70 amperes at 21 volts, equal to 5·25 watts per revolution. The starting switch is of a revolving drum type, with five spring-controlled contacts, somewhat similar to those used in tramcar controllers. The switch is only used for starting the engine, and is controlled by the driver's foot, its normal position making generator connections. The contacts break in oil, and when the engine starts to fire, the current is very low so that no sparking occurs. For engine starting a 100 ampere-hour 12-cell battery delivers current at 24 volts, while, when the pedal is released a spring automatically returns the switch to the generating position, and at the same time links up the cells into two parallel groups of six. An automatic cut-out is provided, by means of which, when the battery is fully charged, the field is cut out, and therefore no damage can occur to the winding of the dynamo through an overcharge of the accumulators. The insulation of the winding is also made heavy, so that the accumulators cannot give out sufficient current to burn or short-circuit the field winding of the dynamo. It is claimed for the system that, acting directly as the engine fly-wheel, the efficiency is higher than where gears, chains, or other power transmission devices are employed.

The White.—On the White petrol cars, which are built at Cleveland, U.S.A., a combination lighting dynamo and engine starter is employed, this working in conjunction with a nine-cell battery. Notwithstanding that the two functions are combined in the one machine, the armature remains the only moving part; it is of a relatively low-speed type, enabling it to be permanently connected to the engine at a low gear ratio, it being claimed to have an advantage in this respect over those in which gears have to be brought into and out of mesh. The machine is driven by and starts the engine through a chain drive, the full 18 volts being employed for starting, while only 12 volts are used on the lighting circuit.

(To be continued.)

Eye-preserving Glass.—As the result of a prolonged research, Sir William Crookes has succeeded in devising glasses of special composition which effectually preserve the eye from the injurious effects of intensely-heated molten glass, &c., cutting off practically all the ultra-violet rays and more than 90 per cent. of the heat rays. Unfortunately, these qualities cannot be combined in one specimen of glass in the highest degree; but a glass can be made which possesses both to a great extent.

Finsbury Technical College O.S.A.—Finsbury old students are asked to note that Mr. F. R. C. Rouse's new address is 15, Clifton Gardens, Golder's Green, London, N.W. He will be glad to receive particulars of the doings of any old students, especially in the electrical department.

STEAM BOILER WORKING IN ELECTRICAL POWER STATIONS.

The paper on this subject, read by Mr. J. W. Jackson before the Institution of Electrical Engineers (for abstract see Electrical Review, page 779), was discussed at Newcastle on November 10th.

In opening the discussion, Mr. C. Turnbull (Tynemouth Corporation) said that mechanical stokers were not used at sea, because they were only adapted for using small coal, and the cost of installing crushing apparatus would probably outweigh the saving due to the use of mechanical stokers.

Mr. H. H. Baker said that no doubt the superheater position shown in fig. 1 was very nice from a maintenance point of view, but he did not see how high superheats were going to be attained with the superheaters so far removed from the furnace. Another point was that, as the width of a boiler was generally restricted, for greater outputs one had to increase the height of the tubes, and this again meant that the gases would be unable to give the necessary superheat with the superheater in the position shown in fig. 1. He doubted very much whether there was much difference in the cost of maintaining superheaters in either position.

Mr. Innis said that he had had personal experience of superheaters placed low down amongst the tubes, over a period of 3½ years, and so far he had seen no signs of buckling or warping. He admitted that the tubes sooted up, but he did not think that, in this respect, they were appreciably worse than those shown in fig. 1.

Mr. W. M. Selvey said that it was a well-known fact that when a boiler was started up clean the superheat gradually rose as the lower tubes of the boiler got dirty, and when the superheater tubes began to get dirty the degree of superheat commenced to fall. He thought that the figure of 75 per cent. of the total evaporation of a boiler taking place in the front two or three rows of tubes was too high, and, personally, he would not put this above, say, 65 per cent. With regard to the "Bonecourt" and "Nicholson" boilers, his first impression had been that the claim that low final temperatures could be produced without corrosion could not be maintained, especially as gas engine people had, for years, been keen on recovering heat from the exhaust gases, which could not be reduced below a certain temperature without causing corrosion troubles. He had, however, gone very carefully into the matter, and had found that in a boiler using coke oven gas, 78 per cent. of the heating value of which was due to hydrogen, and where 100 per cent. excess air was used, the dew point of the mixture was nearly 100° F., or, in other words, until the gas was cooled to 100° F. no moisture could be deposited. For furnace lining silica bricks were very much superior to bricks containing any traces of iron. He did not think that there was any difficulty whatever in fitting "Lancashire" boilers with mechanical stokers.

Mr. W. Baxter said that while the water-tube boiler was undoubtedly much more "lively" than the Lancashire boiler, the latter had many points of superiority, and he could not understand why greater advantage had not been taken of a combination of these boilers, the Lancashire boilers for the steady part of the load, and water-tube boilers to take the peak load. Mr. Jackson had mentioned the possibility of using superheaters up to 900° F., and he would be glad to have Mr. Jackson's views on the type of turbine blading which would be suitable for these high temperatures. He thought that a good many of the earlier troubles were due to want of consideration or want of knowledge of the theory of combustion, and in view of later knowledge it was difficult to see how anyone could ever expect a Lancashire boiler fitted with Galloway tubes to be smokeless. With regard to air leakages, very few people appreciated what a large amount of air could leak through a brick wall, even if it was free from cracks and well jointed. It had been stated that there was no condensation of sulphuric acid in the "Bonecourt" boiler, but he thought that there must be some because the Skinningrove Iron Co. had lined the chamber at the back of their "Bonecourt" boiler with lead, in order to obviate corrosion. With regard to electrical schemes for the prevention of corrosion in boilers, one at least of these had passed the experimental stage, and he thought that it was largely a question of time before such electrical methods would come into general use.

Mr. Clemitson said that he would be glad to know what was the minimum quantity of steam which could be passed through a superheater without damage to the tubes. He had not observed any great drop of pressure in well-designed superheaters, the area of the tubes in which would be at least two to three times the area of the stop valve; nor had he observed such a great difference as 12 in. between the level of the water in the front and back drums, and he thought that 6 in. would be nearer the mark, even when working at an evaporation of 7 to 8 lb. per sq. ft. Rather than adopt the plan of altering the level of the different drums, as suggested by Mr. Jackson, he thought that it would be much better to lower the water gauge on the middle drum by, say, 6 in. or 7 in., and one would then always be certain that the front drum contained plenty of water. Under the system proposed by Mr. Jackson, in the event of the boiler stop-valve being closed there would be very little water left in the front drum, with the consequent danger of damage to the tubes.

Mr. P. G. Watson (Newcastle Electric Supply Co.) said that it would be a mistake to pay stokers according to the amount of CO_2 produced, depending upon the men handling the ashes to raise questions regarding unburnt fuel, because these men were drawn from the same class, and it would be an easy matter for them to arrange to share the bonus.

Mr. Chas. Vernier, (N.E.S. Co.) Chairman, said that the "Bonecourt" boiler was a very attractive proposition, especially on account of the economy of space, when one considered the relative space occupied by the boilers and turbines in a modern installation. There were three ways of gasifying coal:—(1) Gasifying the coal in producers, and recovering sulphate of ammonia and tar. According to a recent article in the Electrical Review, out of a ton at 13s. 6d., 98 lb. of sulphate of ammonia, value 9s. 9d., could be recovered, and also 2½ cwt. of tar at 10s. per ton, the product thus recovered being worth 11s. out of a total cost of 13s. 6d., and, of course, the gas was produced in addition. (2) The coal could be coked in the usual way. The third system was to combine the first two, first carbonising the coal at low temperatures, and recovering the more volatile products. Out of a ton of coal one could get 20 gallons of good tar worth 30s. a ton, 20 lb. of sulphate of ammonia worth 2s., and 13 cwt. of coke. If the coke was burnt in a gas producer a further 45 lb. of sulphate of ammonia was produced, making altogether 65 lb., and under this system 12s. 6d. worth of by-products was recovered out of 13s. worth of coal, and a total of 20,500,000 B.TH.U. was available.

Mr. J. W. Jackson (in reply) said that he did not know of any experiment with mechanical stokers on ships, but he did not think that there would be any difficulty in procuring the necessary small coal. The old type of superheater was undoubtedly more costly than the new type, but had a much longer life, and lower maintenance costs. In the earlier type of superheater the temperature of the gases would be somewhere between 1,200° F. and 2,000° F., and this should be ample, even for superheats as high as 900°. The figure of 75 per cent. was a comparative one only, and he would not like to be tied to it. He agreed that pure silica bricks were very satisfactory, except that they had low mechanical strength, and were frequently crushed due to pressure on the arches. With regard to the type of blading most suitable for highly superheated steam, he thought that the impulse type was undoubtedly the best. In his opinion Galloway tubes had nothing to do with the production of smoke in a boiler, as combustion should be completed before the gases had time to reach the tubes. The minimum quantity of steam it would be safe to pass through a superheater would depend upon its exact position in the furnace. He still maintained that it was advisable to vary the level of the drum in a water-tube boiler.

It was quite a good scheme to put sheet steel round boiler settings, but care had to be taken that, in the event of the brickwork cracking, part of the gases did not find their way between the brickwork and the sheeting, thus short-circuiting the boiler. With regard to Mr. Watson's objection to the scheme of paying firemen according to the CO_2 produced, he did not think that even extra money would induce the men handling the ashes to work in a tunnel in which there was a large quantity of burning fuel. With regard to the gasification of coal, up to now one had had to be content with promises and figures, and he thought that, in any such scheme, the capital cost would be unduly high.

PAYMENT BY INSTALMENTS.

[From our Legal Contributor.]

It constantly happens that in the carrying out of engineering works it becomes necessary to provide for payments on account as the work proceeds. Most contractors would be unwilling, and many would be unable, to find all the capital in the first instance; and a custom has accordingly sprung up, according to which, when a certain part of the work is done, the contractor is entitled to a certain percentage of the contract price.

While the chief duty of the engineer in relation to a contract for the erection of machinery is to supervise the work of the contractor, it is by no means an unimportant part of his duty to decide, subject to the terms of the contract, how the contractor shall be paid, and whether he is keeping up to time, having regard to all the unforeseen difficulties which may arise. Thus, at the very outset of the work, it may become impossible, owing to the flooding of foundations or other unexpected difficulty, for the contractor to proceed. In these circumstances, what about the payment of instalments?

It may be premised that where the method of payment is fixed, nothing becomes due until the contractor has done everything to entitle him to receive payment. Each certificate for an instalment creates a debt due, and the contractor is entitled to immediate payment thereof, subject to the terms of the contract, and to any right of the employer to any set-off or counterclaim. As a rule the engineer authorises the contractor to be paid and otherwise expresses his approval of work done by means of a certificate. To save trouble and to avoid disputes the contract should provide for a written certificate. Otherwise a mere verbal statement may be sufficient. For instance, in Elmes *v.* Burgh Market Co. decided in 1891, a contract provided that "the contractor shall receive payment for his work at the rate of £80 per cent., for the works completed on the surveyor's certificate of completion, and the balance at the end of the term of maintenance, less deductions that may be made in accordance with the terms of the contract, and on the surveyor certifying that the whole of the works are in a complete and satisfactory state." It was held that a certificate within the meaning of this clause might be given orally by the surveyor. Where a written certificate is expressly required, the contractor is helpless unless it be forthcoming. He cannot sue the employer for the price of the work he has done, unless, indeed, he can show that the certificate has been withheld by the engineer acting in collusion with the employer.

The mere fact that the engineer by granting a progress certificate during the course of the work appears to express approval of that which is already done, will not enable the contractor to sue for payment. The "progress certificate" is sometimes termed a "certificate on account." In the form of model conditions sanctioned by the Institution of Electrical Engineers it is specially provided that no such certificate is to prejudice the rights of the purchasers against the contractor or relieve the contractor of his obligations for the due performance of the contract. It is usual to make provision for progress certificates by saying that the contractor shall be entitled upon the certificates of the engineer to payments by the employer in accordance with provisions to the following effect: (1) As the works progress 80 per cent. upon the contract value of the work from time to time delivered or executed on the site to the satisfaction of the engineer; (2) the remaining 20 per cent. (usually termed the retention money) in respect of each distinct section or part of the works as follows:—(*a*) 10 per cent. at the expiration of one month after the employer takes over the works, and (*b*) 10 per cent. at the expiration of nine months after the first 10 per cent. becomes due under (*a*). Payments made under the former provision are made on "progress certificates." To avoid any chance of misunderstanding, it is as well to insert a clause providing that the certificates given during the work shall not in any way prejudice the employer in the final settlement of accounts in case it should appear that the contractor has been paid too much.

Where, after the payment of money to the contractor on account, he fails to complete, owing to his own default, or abandons the contract without good cause, the employer may be entitled to recover the instalments paid on the ground that the consideration has wholly failed; but at all events the employer would have a ground of action for a breach of the contract to complete in which the damages recovered might be equal or exceed the amount paid on account.

Lead.—Messrs. James Forster & Co. report as follows, under date November 22nd:—"Closing prices last week were £18 12s. 6d. November, £18 7s. 6d. December, £18 March, with buyers for prompt at £19, and February £18 2s. 6d. After the severe fall in values at the end of last week, we had a moderate recovery at the beginning of this week, the best prices being reached on Wednesday, when £19 3s. 9d. was paid for November, £18 15s. December, £18 6s. 3d. February, with buyers at £18 10s. January. The market has since reacted, the closing prices being £18 17s 6d. November, £18 10s. December, £18 2s. 6d. January, £18 February, and £17 18s. 9d. March. Arrivals for the first half of the month amount to the large total of about 8,000 tons, which has given a welcome relief to the long-prevailing scarcity. Lead, however, continues scarce, little prompt stuff is offering, and the intrinsic position does not justify any considerable reaction in prices, but sentiment is pessimistic in all metals; there is no speculative activity on the "bull" side, and with leading interests selling, the tendency is slack. Export demand is active, but home consumers are not in evidence as buyers. With Mexican affairs still at a deadlock, there is little prospect of a plentiful supply, but, on the other hand, trade in lead, as in other metals, is falling off, and existing supplies seem to be sufficient in the meantime. English lead, £19 5s. to £19 10s."

PRESSURE RISES.

By W. DUDDELL, F.R.S.

(*Abstract of Inaugural Address delivered by the President of the* Institution of Electrical Engineers, *Nov. 13th*, 1913.)

The principal causes of pressure rises may be broadly divided into three classes:—(1) Resonance, (2) Switching, (3) Arcs and sparks.

Resonance.—An electric circuit which contains self-induction and capacity has, as is well known, a free period of its own, and electric oscillations may be produced in it provided that the resistance does not exceed a certain limit. If an alternator is connected to such a circuit, and if the period of the circuit is the same as the periodic time of the alternating E.M.F., then very violent oscillations may be set up in the circuit.

A limit to the strength of the oscillation is set by the apparent resistance of the circuit—by apparent resistance in this connection I mean a quantity which, when multiplied by the square of the current, gives the total losses in the circuit, including iron losses, eddy-current losses, etc., under the given conditions. For instance, if the apparent resistance R is comparatively small, then the voltage on the condenser or self-induction may rise to approximately ω L/R or 1/ ω C R times the E.M.F. of the alternator, where L is the self-induction, C the capacity and $\omega = 2\pi f$, f being the frequency.

The most general case that occurs in parctice is a long unloaded cable which is connected to an alternator. In this case the self-induction in the circuit is mainly the self-induction of the alternator itself, and the capacity is the capacity of the cable. Resonance may be expected to take place if the period $1/f$ of the alternator is the same as the free period of the circuit. This case does not occur frequently under normal working conditions.

It is easy to show that in order to obtain resonance at any frequency the capacity current taken by the cable under normal voltage must be equal to the short-circuit current of the generator at normal excitation and at the frequency considered. No station could very well be run in this condition, as it means that the capacity current of the cables considerably exceeds the normal output of the generator. Although I have observed many cases of resonance of a 3rd, 5th, 7th, and higher harmonics, I have seldom seen cases of resonance of the fundamental.

If the wave form of the alternator is not a pure sine wave, a resonance of one of the upper harmonics is quite possible, since it is evident that as the frequency increases the capacity current taken by the cable increases and the short-circuit current for that frequency decreases, so that they rapidly approach one another. Resonance of the 5th and higher harmonics may be expected in practice.

With modern alternators resonance seems to have practically disappeared in this country. In the early days I had some bad cases to investigate when resonance of one or other of the harmonics took place, which either caused failures or difficulties in regulating the voltage. With the modern machines the 3rd, 5th, and 7th harmonics are generally so small that there is no trouble from their resonating. Resonance of the higher harmonics is more likely to take place, but owing to the very much greater losses due to eddy currents, hysteresis, etc., the resonance of these higher harmonics does not in general attain a serious magnitude, especially if there is any load on the machine.

In the ordinary three-phase systems the wave forms between the phases are practically free from the 3rd harmonic, but this is not necessarily true of the wave form between each of the terminals and the neutral point. Care must therefore be taken that the resonance of this harmonic does not occur.

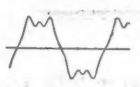
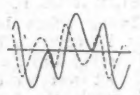
Fig. 1.  Fig. 3.

Fig. 2.  Fig. 4.

From this cause there might be quite a considerable potential difference between each of the cores of the cable and earth, whereas a record of the wave forms taken between the cores might show nothing abnormal.

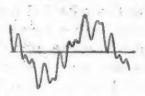
As a few examples of resonance of the higher harmonics observed in generating stations when the alternators were connected to feeders on open circuit, the following may be of interest.

Fig. 1 is the open-circuit wave of an old type of 400-kw. 2,000-volt alternator, and Fig. 2 is for the same machine connected through a 3:1 transformer to two of the feeders. The record which was taken on the high-tension side of the transformer shows a marked resonance of the 3rd harmonic, causing the potential-difference wave to fall almost to zero once during each half-period. The maximum volts are 10,140, or 1.60 times the R.M.S. value instead of 1.41 times for the sine wave. This is quite an exceptional case, owing to the shape of the open-circuit wave and the large capacity of the cables in comparison with the size of the machine.

Fig. 3 shows the open-circuit wave of a more modern 500-kw. three-phase 6,600-volt generator, and Fig. 4 is for the same machine connected to two of the feeders. A resonance of the 13th harmonic has taken place and the maximum voltage has risen to 14,000, or 2.33 times the R.M.S. value.

The effect of the changes in speed on the wave form near a resonance is exemplified in Fig. 5, which shows the open-circuit wave of a 330-kw. 5,000-volt generator at normal speed, and in Fig. 6 for the same machine con-

Fig. 5. Fig. 7.

Fig. 6.  Fig. 8.

nected to four feeders. An increase of 8 per cent. in the speed produces Fig. 7, and a reduction of 26 per cent. Fig. 8.

The importance of the observation is that alternators should never have their speed run up or down when excited and connected to cables on open circuit, for fear of passing through a possible resonance of an upper harmonic. In this connection I should like to draw attention to the case of switching-off at the generating station a feeder connected at its far end to a running motor or rotary converter. When the switch opens, the cable is left connected to the running motor or rotary converter, which acts for a short time as a generator. As the machine slows down there is a considerable risk of a resonance, the more so as the self-induction of the motor or converter may be high enough to give a resonance even of the fundamental. An example of this effect is shown in Fig. 9, in which a feeder supplying two motor-generators in a sub-station was disconnected from the busbars by tripping the oil switch.

Fig. 9.

The busbar pressure was 6,420 volts, but the maximum peaks on the record after the switch had opened are no less than 16,200 volts, due to a resonance of the 13th harmonic during the short time that the motor-generators were slowing down with the feeder on the open circuit connected to them.

Directly there is any appreciable load on the system the risk of a serious resonance becomes very small and rapidly vanishes. Should, owing to any cause, the load be suddenly switched off the ends of long feeders so as to leave them unloaded and connected to the generator, there is the probability of a pressure rise due to the combination of resonance, a rise in the speed of the generator, and interrupting the current, referred to below under "Switching."

There are certain special cases in which resonance of the fundamental may appear in unexpected ways. In an actual example, a three-phase voltmeter transformer was connected to the busbars on the high-tension side by means of a fairly long length of cable. At the busbar ends of the cable were disconnecting links. It was found that if one of the links at, say, *b* (Fig. 10) were in place, the other two being open, a high voltage occurred between either of the other terminals and earth. The neutral point of the generator was earthed, and each of the cables between the busbars and the instrument transformer had a capacity of about .005 mfd. to earth. A circuit was thus formed through the closed link *b*, two coils of the transformer in series, and the capacity of the lead to earth back to the neutral point. The self-induction of the two coils of the transformer in series was just about sufficient to give a resonance when in series with the capacity of the cable to earth at the ordinary working frequency. The voltage, which should have been 4,620 (8,000 volts between phases) between *a* or *c* and earth was observed to be 10,100, or more than double the proper value. On disconnecting the pieces of cable between *a* and *c* and the transformer, the observed voltage on the open legs of the transformer fell to 4,700, practically normal value. Every time a voltmeter transformer was put in or out of circuit by withdrawing the link, the somewhat dangerous condition had to be passed through where one of the legs of the transformer was submitted to something like twice the normal pressure.

As another possible example take the case of a 100-kw. single-phase transformer supplied at 6,000 volts through a feeder one mile long and feeding into a distributing network. If the capacity of the feeder be taken as 0.25 mfd. the capacity current at 50 frequency will be just under

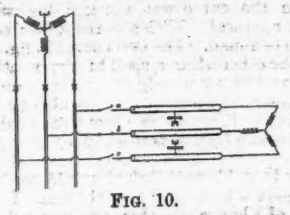


Fig. 10.

½ ampere. The magnetizing current of the primary of this transformer may not differ much from ½ ampere, and there is thus a possibility of a pressure rise should the feeder be disconnected at the generating station, leaving the transformer connected on the low-tension side transforming up and making the cable alive. If there was much magnetic leakage in the transformer this rise might be serious.

In two-phase or three-phase systems a number of combinations of the cables and transformers exist where, if a connection be opened, or during switching, the self-induction of the transformers may be in series with the capacities of the feeders, as pointed out by Steinmetz.

Summing up, it may be said that resonance at the fundamental frequency is rare but very dangerous when it does occur. Resonance of an upper harmonic is much more frequently observed, but with the good wave forms of modern turbo-alternators the amplitudes of the upper harmonics are so slight that their resonance does not generally produce any dangerous pressure rise.

Switching.—In switching apparatus in and out of circuit there are a certain number of cases in which the pressure may rise considerably above the normal irrespective of any arcing or sparking which may take place at the contacts. The best known is probably the ordinary case of opening an inductive circuit such as the field coil of a generator. If the rate at which the current is suppressed is sufficiently great, very high voltages can be produced, because the whole of the energy that is stored in the self-induction is set free, and must be either dissipated or stored in some available condenser. If an uncharged condenser is suddenly switched on to a generator, then in the general case the potential difference between the terminals of the condenser will rise not only to that of the generator but will overshoot the mark, and may, in the extreme case if there are no losses, reach twice the value. This is analogous to the ordinary case of the ballistic galvanometer in which, when the damping is small, the initial deflection on switching it into circuit is twice the steady deflecton.

We have here, therefore, two fundamental cases where pressure rises may easily occur in practice, namely, when inductive circuits are suddenly opened or when condensers

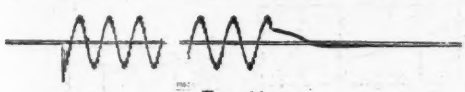


Fig. 11.

such as cables are suddenly charged. The simple case of the inductive circuit is so well known that nothing more need be said about it except to point out that in the case of long feeders where the currents are large the energy stored in the self-induction of the feeders may be quite considerable; this is especially the case with continuous-current feeders.

As examples of the voltage rise when switching on a capacity, Fig. 11 shows the case of switching on and off 3 miles of cable on open circuit at 5,600 volts to a 1,000-kw. generator by means of an oil switch. The peak of the potential-difference curve is 14,500 volts, or about 2.6 times

Fig. 12.

the R.M.S. value. The switching-off of the cables gives no rise, the cable behaving like a simple concentrated condenser. The fine ripples on the curve are due to a high harmonic slightly resonated.

As another example, Fig. 12 shows the switching on and off of about 2 miles of cable by means of an air-break switch from a 5,000-volt generator of an old type which had not a very good wave form. At the moment of switching on the potential difference rose to 11,000 volts, or 2.2 times the R.M.S. value. It is to be noted that after the first contact at the switch the cable becomes charged by the oscillations. The switch then breaks contact and the charge in the cable leaks away through the oscillograph giving part of a discharge curve. About 1/200th of a second later, while the cable is still partly charged, the switch makes contact again and the cable is recharged, but this time in the reverse direction, from the following half of the wave form. The cable again becomes charged by the oscillations and finally settles down.

This effect of a switch not making perfect contact may lead to high pressures, because the upper limit to which the voltage on the condenser may swing is twice the difference of potential which is suddenly applied to it. For instance, if after the first contact the cable is left charged to a potential $+ v$ and then contact is made again at the middle of the following half-period when the voltage is $- v$, the change of voltage applied to the condenser is $V+v$, and the first swing may amount to $2 (V+v)$, or the voltage rise measured from the zero line, $2 (V+v)-v$, say $2 V+v$. In the worst case of $v=V$ we have a maximum of $3 V$; or for a sine wave say 4.2 times the R.M.S. voltage.

I have already stated that no rise of potential takes place when switching off a condenser. If, however, sparking or vibration takes place at the contacts the effect just mentioned may occur. Fig. 12 is a good example where the cable was switched off from the machine, and it shows that while the cable was discharging after the first switching off the switch made contact again and re-charged the cable in the reverse direction. During the following discharge the switch again made contact and re-charged the cable, giving a pressure rise to 12,900 volts. The switch now finally breaks contact and the cable discharges with a tendency to a slow oscillation.

A bad case of vibration of the contacts of switching combined with a resonance is shown in Fig. 13, in which about 12 miles of feeder were switched on to the 400-kw. generator already mentioned (see Fig. 1). The cable was not quite discharged from previous experiments at the moment the switch made contact. The ordinary rise, but

Fig. 13.

not a serious one, took place, and the switch remained closed for little over half a period. It then broke contact for approximately half a period; after which it re-made contact, giving a high rise in the reverse direction to 5,100 volts from a R.M.S. value of 2,000. During the next half-period the switch appears to have made good contact, but during the following one it has again been faulty in its contact. The moral is: Use a switch which closes quite clean without any chattering of its contacts, and switch on under oil, as the risk of a leading spark is thereby greatly decreased.

The smaller curve is the current flowing into the cable, which current it will be noticed has three times the fundamental frequency, owing to the fact that the conditions are practically the conditions of the resonance of the third harmonic of this machine already referred to. The results of a very large number of tests of switching on and off cables on open circuit show that in general on switching on the cable, if no sparking takes place, the peak rarely exceeds twice the R.M.S. voltage, and that there is no rise on switching off. If, however, vibration of the contacts takes place or sparking, which will be referred to again later, then the peak may be more serious. If the switch is in good condition, however, the upper limit of the peak may, I think, be safely taken at three times the R.M.S. voltage.

As all cables and apparatus should at least be able to stand safely twice the working voltage for short periods, to switch on a cable should be quite safe provided no serious sparking takes place at the contacts.

I have so far mentioned the cases of a capacity or a self-induction, *i.e.* a cable or a winding of a machine suddenly switched in or out of circuit. The next case is the switching in and out of a circuit which has both capacity and self-induction; in this case oscillations may be produced if the resistance is low enough.

Consider an infinitely long cable, and let it be suddenly connected to an alternating-current generator at the moment when the potential difference is zero. As the potential difference increases at the generator end of the cable a current will flow into it charging up the condenser formed by the cable and earth, and this charge will travel along the cable with a certain velocity. Owing to the resistance and capacity of the cable the quantity of electricity flowing along it will become less and less as the charge travels along, so that one may look upon the wave travelling down the cable as being of continually decreasing amplitude. As the wave travels down the cable with a certain velocity the alternator continues to revolve, that is to say, the phase of the current wave applied to the end of the cable is continually changing, so that the phase difference between the alternator wave and the current wave travelling down the cable increases progressively. The net result is that in a very long cable the wave travelling along the cable continually diminishes in amplitude and lags behind the generator in phase.

(To be continued.)

THE CHARACTERISTICS OF INSULATION RESISTANCE.

By S. Evershed, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Birmingham, November 26th, and London, November 27th*, 1913.)

During recent years a great deal of valuable research work has been done to increase our knowledge of the properties of insulating materials, yet notwithstanding the progress so made the natural laws governing insulation resistance are but little understood.

The only insulating materials whose behaviour in use corresponds with their predetermined dielectric properties are those which are non-absorbent. Of the remainder, and they form the majority of the materials in common use, we can only predict that the insulation resistance of any electrical system in which they are used will be governed almost entirely by the moisture they absorb. Everyone knows that insulation resistance decreases on a damp day and recovers during dry weather. It is perhaps not so generally known that in most cases insulation resistance decreases, in a perfectly definite way and almost instantaneously, as the electric pressure upon it is increased, and slowly recovers if the pressure is restored to the initial value or cut off altogether.

The effects of moisture, voltage, polarity, and other phenomena commonly met with in insulation have been forced upon the author's attention for many years past, and the pressing need to find answers to the questions that so frequently arise in connection with insulating materials induced him to undertake an experimental research with a view to the better understanding of their behaviour in everyday use. This work has been in progress for three years. The author has sought, by investigating the nature of leakage conduction, to establish some definite relation between applied potential difference and insulation resistance. If the curve expressing this relation be traced from a few volts up to the breakdown point, it will be found to consist in general of two parts of opposite curvature more or less like the voltage-resistance curve shown in fig. 1.

The shape of the first part of this characteristic curve is determined by the extent to which leakage is due to moisture; leakage through the substance of the insulator—dielectric leakage—is negligibly small compared with that caused by the merest trace of moisture. For most practical purposes an insulator may be regarded as having no inherent conductivity, the conducting power which it appears to possess being usually caused by leakage over damp surfaces, and if the insulator is porous, through the capillary channels inside the material.

The investigation of the second or breakdown part of the complete curve (see fig. 1) is still in the preliminary stage, and the present paper deals mainly with the first part up to the point or region of inflection.

When a conductor resistance is measured, care is taken to avoid the introduction of any extraneous electromotive forces due to polarisation, induction, capacity or thermo-electric junctions. But with insulating materials similar precautions are not generally possible, and all that can be done is to measure the ratio of applied potential difference to the resulting current, V/I, and call that the insulation resistance, though the "ohms" so obtained are not necessarily of the same nature as the ohms in a metallic conductor.

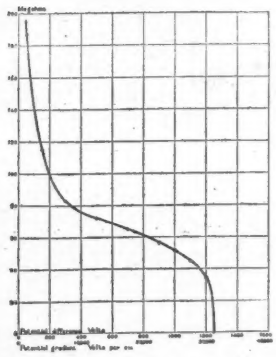


Fig. 1.—Complete Characteristic Curve for Cotton containing a Normal Amount of Moisture Absorbed from the Air.

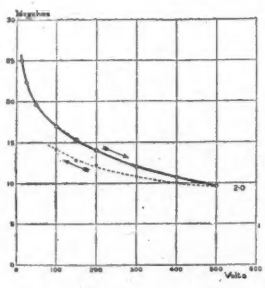


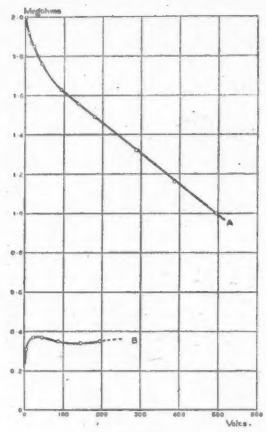
Fig. 2.—Insulation Resistance of a Dynamo Armature, Showing Hysteresis Effect.

The greater part of the work was done by means of a Broca galvanometer, made by the Cambridge Scientific Instrument Co.; the pressure was supplied by a battery of secondary cells giving about 500 volts. When leakage conduction is to be detected or measured, continuous current is essential.

Guarded insulation—the method of Price's guard wire extended to include every material insulating point in the testing apparatus—is now universal in insulation testing. This happy invention was used throughout the present investigation, and hence the current measured was in every case the current it was intended to observe and nothing else.

In the choice of examples it does not matter what kind of insulators are involved; so long as their resistance is within the range of measurement, they will nearly all tell the same tale of a gradual fall in the resistance as the testing voltage is increased.

Fig. 2 is a typical moisture curve, indicating that the insulation is entirely composed of absorbent materials. It is important to note that when the curve was retraced backwards a kind of hysteresis effect appeared. With absorbent insulators this effect is nearly always to be found. The two curves in fig. 3, one traced on a wet day and the other after a spell of dry weather, show that a large excess of moisture not only lowers the general level of the resistance but also brings about an entire change in the character of the curve. In the lower curve three things which are characteristic of conduction by moisture are struggling for the mastery. On a wet day every solid insulator is covered with a film of water, which if it were in stable equilibrium would conduct according to Ohm's law and give a horizontal straight line. But instability is a marked feature of films when they are exposed to the air, and hence in practice the curve is never a simple straight line. In addition there is some typical conduction through absorbent insulators, and the curve is the resultant of all three effects.



A, in dry weather.
B, in very wet weather.

Fig. 3.—Insulation Resistance of Lighting Circuits.

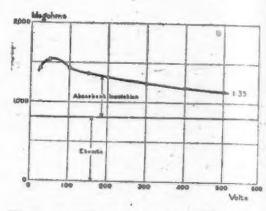
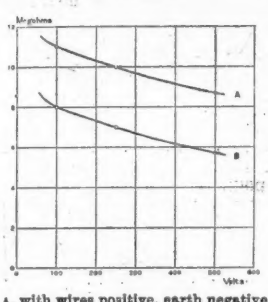


Fig. 4.—Insulation Resistance of a Supply Meter.

The curve in fig. 4 is typical of insulation that is made up of an absorbent insulator in series with one which has a more nearly constant resistance. Fig. 5 is remarkable because it shows that the resistance was affected by polarity. The polarity effect is a strongly marked characteristic of earthenware insulators.

Prolonged experiments were made on a large number of materials which are in common use for insulating purposes. The materials included rubber, gutta-percha, micanite, porcelain, cotton, paper, silk, oils, and varnishes.



A, with wires positive, earth negative.
B, with wires negative, earth positive.

Fig. 5.—Insulation Resistance of Interior Wiring, Showing Polarity, or "Valve," Effect (Ohmmeter Test).

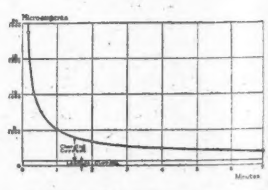


Fig. 6.—Leakage Current Plus Charging Current Flowing into a Rubber Cable, from 0 up to 7 Minutes.

Our object being to learn something about conduction through moisture, any dielectric leakage there may be through the substance of the insulators can only be ignored if we first show that dielectric resistance is enormous in comparison with the resistance of the leakage paths which are formed by traces of moisture.

The only non-absorbent insulators which were tested were gutta-percha and rubber. These are both non-absorbent in the sense that what little water they may be capable of absorbing is entirely unable to form leakage paths through the insulator. Submarine cables insulated with these materials have been lying on the bottom of the sea for half a century or more, and, so far as the author is aware, no trace of conduction by absorbed water has ever been detected in a sound cable.

Rubber as an insulator for cables is so extensively used in every branch of electrical industry that it is naturally the example chosen for illustration. The test sample was a rubber-covered flexible cable made up of 64 6-mil wires, insulated in accordance

with the standards of the Cable Makers' Association, and guaranteed to have an insulation resistance of not less than 600 megohms for 1 mile after 1 minute's electrification. The rubber is between 35 and 37 mils in thickness, and consists of one layer of pure Para and two layers of vulcanised rubber. This flexible is used by the author's firm for the interior connections of naval gear, and for that purpose it is supplied without any covering outside the rubber; it was, therefore, in suitable form for an under-water test. A length of this cable—equal to one-sixteenth of a mile—was put into a bucket of water, where it remained for 40 days. The tests which were made during that period consisted in charging the cable at about 500 volts and observing the total current flowing into it at intervals of time, so that a time-current curve might be drawn.

The charging current dies away rapidly at first, then more and more slowly. Ultimately, possibly after many hours, the only appreciable current passing through the galvanometer will be the true dielectric leakage. The actual result of a test of this kind, made after the flexible had been in the water for 10 days, is shown in figs. 6 and 7. In fig. 6 the time-current curve is given from 10 seconds up to 7 minutes after the closing of the charging circuit; while fig. 7 shows the same curve from 3 minutes up to 420 minutes (7 hours).

Incidentally, these two diagrams afford a good illustration of the misleading appearance of curves of this class. Judging from fig. 6, one would infer that within 4 or 5 minutes the current was

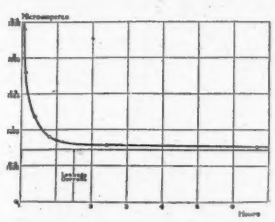


FIG. 7.—LEAKAGE CURRENT PLUS CHARGING CURRENT FLOWING INTO A RUBBER CABLE; CONTINUATION OF THE TIME-CURRENT CURVE IN FIG. 6, UP TO SEVEN HOURS.

already nearly approaching its final steady value. But we have only to change the time scale from minutes into hours, and magnify the current scale by a substantial amount, and the curve conveys a very different impression. Instead of a few minutes, an hour or more must elapse before the current can be said to be "well round the bend of the curve."

The charge was continued for 27 hours without a break, and by that time the current had fallen to 0·00072 micro-amperes at 525 volts. This was assumed to be the true dielectric leakage current, and its value is indicated on each of the diagrams by a horizontal line.

(To be continued.)

University Education in London.—The President of the Board of Education has sent to the Vice-Chancellor of London University a letter in which he announces that the Government, after careful consideration, have decided that the scheme of the report of the Royal Commission on University Education in London is calculated to produce a University of London worthy of the name. It will be the business of the Departmental Committee to discover how far the numerous bodies and persons concerned are prepared to co-operate on the basis of the principles underlying the scheme.

Those principles may be shortly stated as follows:—

1. That the government of the University, and particularly its financial administration, shall be entrusted to a small Senate predominantly lay in its composition, and not representative of special interests; and

2. That, on the other hand, the control of the teaching and the examinations of students in colleges of the University shall be in the hands of the teachers.

3. That the educational and financial control of the constituent colleges shall be vested in the University.

4. That as much of the University work as possible, together with the University administration, should be concentrated in a central University quarter.

5. The scheme of reconstruction should provide effectively for continuance of access to University examinations by external students, *i.e.*, by those who are not attached to any college or school of the University.

As regards the future of the Imperial College, it has never been proposed that the college should be moved from its present site. It is, however, an essential part of the scheme that it should become a constituent college of the new University under "the educational and financial control" of the Senate.

On the conclusion of the necessary negotiations the Government hope to introduce legislation in due course to give effect to these principles.

The scheme of the Royal Commission is the only one in the field, and if it fails of accomplishment all chance of reform and progressive development may be gone for many years.

The Government will be prepared, in the event of the scheme taking shape in legislation, to make substantial new contributions to the resources of the University.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

CAMEROONS.—A new tariff, which has been put into operation as from August 24th last, provides for a duty of 20 per cent. *ad valorem* on iron wares of all kinds and a duty of 10 per cent. on goods not specially mentioned in the tariff as not included in the free list.

FRANCE.—The Board of Trade have received information from the French Customs Department to the effect that the Customs Service may take the declaration respecting the electric equipment of tramway cars to be correct if such declaration is corroborated by a detailed note showing the weight of each part of the equipment and where such part is to be used.

The October issue of the Circular of the British Chamber of Commerce calls attention to a method of importing heavy machinery into France at the lowest rates possible. It often happens that a machine is too heavy or too bulky to be sent in one shipment. If, however, it is sent in two or more shipments, the French Customs authorities refuse to accept its declaration as a complete machine. The Circular suggests the following method by which British shippers of machinery may avoid this difficulty, and in many cases save expense:—Application should be made to the local Director of Customs for permission to import the machinery in two or three shipments, as the case may be, within a time limit of 60 days. A plan of the machine and a list of all its parts must be deposited in advance at the importing Custom House, and each shipment must be accompanied by a list carefully designating the parts contained in that shipment. The importer must sign a "soumission," undertaking to pay on the whole as "detached parts" if, after final shipment, it is found that the machine is incomplete. All shipments must be made through the same Custom House, and it is, of course, understood that spare parts will have to pay the duty proper to them as "detached parts."

PORTUGUESE COLONIES.—A decree of the Minister of Colonies provides that the exemption from duty of goods imported into the Portuguese Colonies by, or for the use of, the Government, shall be extended to telegraphic materials. In order to enable these goods to be imported free of Customs duty, the authorisation of the Governor of the Colony must be obtained and the legal formalities in connection with Customs clearance must be carried out.

BARBADOES.—In connection with the provisions of the recent treaty between Canada and the West Indies, which provides for preferential treatment of British and Canadian goods, an Act of the Barbadoes Government provides that in the case of goods imported at general tariff rates between June 2nd and September 30th, 1913, and in respect of which satisfactory evidence has been, or shall be, produced to the Comptroller of Customs that such goods are the produce or manufacture of a British country and entitled to preference under the existing laws of the island, a refund of any payment in excess of the amount payable under the British Preferential Tariff will be made on the order of the Comptroller of Customs. The Act also empowers the Comptroller of Customs to decide any question that may arise as to the origin of goods imported up to October 1st last.

NICARAGUA.—The Board of Trade have been informed by the Foreign Office that in connection with the certificates of origin for goods liable to a rebate of 25 per cent., in accordance with the treaty between Nicaragua and France (which is also applicable to British goods), any form of certificate of origin which properly describes and identifies the goods shipped, will suffice to obtain for the goods the rebate of duty in question, provided that it contains a certificate from a Chamber of Commerce or a competent officer of the Government of the country of origin to the effect that the goods are the produce or manufacture of that country.

BOLIVIA.—A Bill has recently been laid before the Bolivian Congress, by which it is proposed to authorise the Executive to reduce the export duty on rubber, if necessary, to 2 per cent. *ad val.* from the present legal minimum of 8 per cent. It is proposed that the tax shall be levied upon 70 per cent. of the London market quotation of the rubber, 30 per cent. being deducted for cost of production.

NEW PATENTS APPLIED FOR, 1913.

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

25,621. "Electric soldering irons." L. NEWITT and F. P. FLETCHER. November 10th.

25,625. "Shades for electric and other lights." J. RED. November 10th.

25,643. "Telephonic receiving-apparatus." WESTERN ELECTRIC CO., LTD. November 10th. (Franklin Tuthill Woodward, Belgium.) (Complete.)

25,659. "Telephone repeaters." WESTERN ELECTRIC CO., LTD. November 10th. (Franklin Tuthill Woodward, Belgium.) (Complete.)

25,666. "Electric-light pendants." F. DEHLER. November 10th. (Convention date, February 15th, 1913, Germany.) (Complete.)

25,668. "Apparatus for the preparation of electric baths." J. DUIVEN. November 10th. (Convention date, November 13th, 1912, Switzerland.) (Complete.)

25,675. "Attachment plug for electric circuits." F. H. CHAPMAN and O. E. KENNY. November 10th. (Convention date, February 24th, 1913, United States.) (Complete.)

25,695. "Reactances or choking coils." K. M. Faye-Hansen. November 10th.

25,701. "Device for discovering fractures in wire cables." R. Wahn. November 10th. (Convention date, November 11th, 1912, Austria.) (Complete.)

25,716. "Electrical measuring apparatus." M. E. Leeds. November 10th. (Convention date, November 18th, 1912, United States.) (Complete.)

25,717. "Apparatus for recording electrical, chemical, mechanical, physical, and other quantities." M. E. Leeds. November 10th. (Convention date, November 22nd, 1912, United States.) (Complete.)

25,720. "Telephone systems." M. Suwa. November 10th. (Complete.)

25,727. "Electrical accumulators or secondary batteries." H. W. van Raden. November 11th.

25,743. "Shade holder and lamp lock for incandescent electric lamps." T. McClelland, Junior. November 11th.

25,767. "Electro-magnetically-operated reciprocating mechanism." W. H. James. November 11th.

25,774. "Method and apparatus for electric code impulse signalling systems." Western Electric Co., Ltd. November 11th. (F. T. Woodward, Belgium.) (Complete.)

25,780. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and A. B. Sperry. November 11th.

25,787. "Compounds for use as coatings or coverings for insulating purposes." A. J. Roach-Cuming. November 11th.

25,788. "Compounds for use as coatings or coverings for insulating purposes and the like." A. J. Roach-Cuming. November 11th.

25,790. "Insulating covering for overhead wires." G. H. Vaughan. November 11th.

25,795. "Audible electric signalling devices and the like." W. A. Crosbee, F. S. C. Crosbee, and T. S. Rogers. November 11th.

25,796. "Audible electric signalling devices and the like." W. A. Crosbee, F. S. C. Crosbee, and T. S. Rogers. November 11th.

25,818. "Electric switches and fuse switches." H. H. Berry and W. J. Markham. November 11th.

25,833. "Electric switches." F. B. Holt and H. Smith. November 11th.

25,834. "Electric motor-driven vehicles." K. von Kando. November 11th. (Complete.)

25,846. "Apparatus for converting alternating to direct current." H. Wade. November 11th. (D. A. Heyman, United States.) (Complete.)

25,849. "Vacuum tubes." British Thomson-Houston Co., Ltd. November 11th. (General Electric Co., United States.)

25,852. "Apparatus for regulating electric circuits." H. Leitner. November 11th.

25,855. "Method of generating high tension sparks for ignition purposes." F. H. Teagle. November 11th. (Complete.)

25,901. "Electric signalling system for railways." C. C. Wilson. November 12th.

25,903. "Ignition systems of internal-combustion engines." P. W. Harley. November 12th.

25,914. "Joint for metallic conduits and fittings for electric cables." Simplex Conduits Ltd., and L. M. Waterhouse. November 12th.

25,915. "Electric switches and the like." D. Adamson. November 12th.

25,919. "Apparatus to keep constant the voltage of an electric current obtained from an alternating current dynamo, particularly of the type fitted to certain makes of motor-cars." A. H. Simmons. November 12th.

25,928. "System of apparatus for the distance control of motors." A. Mond. November 12th. (Maschinenfabrik Oerlikon, Switzerland.) (Complete.)

25,951. "Device for tightening-up and separating the sections of trolley wires." F. Lautenbacher. November 12th. (Convention date, December 2nd, 1912, Germany.) (Complete.)

25,954. "Secondary storage batteries or electrical accumulators. O. Oldham. November 12th. (Complete.)

25,957. "Manufacture of alkali metals and alkali metal alloys by electrolysis." Chemische Fabrik von Heyden Akt. Ges. November 12th. (Convention date, November 18th, 1912, Germany.) (Complete.)

25,975. "Method of and means for the electric transmission of signals and speech in mines." R. Haddan. November 12th. (J. H. Reineke, Germany.) (Complete.)

25,977. "Electrically-operated clock mechanism." E. C. Clerc. November 12th. (Convention date, November 21st, 1912, France.) (Complete.)

25,989. "Electric-lampholders." G. St. J. Day. November 13th.

25,990. "Automatic engaging and releasing mechanism." I. H. Parsons. November 13th.

25,991. "Line selector switches." I. H. Parsons. November 13th.

26,006. "Automatic electric circuit-breakers." A. Crawford. November 13th.

26,050. "Method of electrical speed control." E. R. Clark. November 13th.

26,060. "Electrical devices for operating door sashes of automobiles and other vehicles." J. F. P. de la Riboisiere. November 13th. (Addition to 15,648/13. Convention date, December 21st, 1912, France.) (Complete.)

26,061. "Method of and apparatus for electro-osmotic processes." Ges. fur Elektro-Osmose m.b.H. November 13th. (Convention date, July 21st, 1913, Germany.) (Complete.)

26,069. "Electric-starters and lighting and battery-charging systems applicable to motor-vehicles and the like." W. H. Glaser and H. R. Lloyd. November 13th.

26,100. "Interior for electric light lampholders." E. Phillips. November 14th.

26,105. "Electrical slip-ring or collecting-ring." H. C. Sanders. November 14th.

26,109. "Electrical knock locator for use in connection with engines, pumps, and the like." J. L. Cochrane. November 14th.

26,149. "Method of manufacture of insulation between two metallic bodies." S. G. Leach and H. F. Joel, Junr. November 14th.

26,150. "Springs used in electrical work." S. G. Leach and H. F. Joel, Junr. November 14th.

26,181. "Dynamo-electric machines." T. W. Tattersall and J. W. Tattersall. November 14th.

26,198. "Pulleys for the trollies of electric railways, tramways, and like purposes." A. Welsh. November 15th.

26,226. "Electric signalling system for railways." C. C. Wilson. November 15th.

26,251. "Electrical accumulators." H. C. Weeks. November 15th. (Complete.)

26,252. "Apparatus for perforating strips in dot-and-dash codes or the like." C. F. Casella & Co., Ltd., and R. M. Abraham. November 15th.

26,268. "Contacts for closing electric circuits." J. E. Colas. November 15th. (Convention date, November 15th, 1912, Belgium.) (Complete.)

26,273. "Systems of electro-medical and therapeutical treatment." J. P. Pullin. November 15th.

26,278. "Automatic telegraph transmitters." Eastern Telegraph Co., Ltd., K. L. Wood, and A. Fraser. November 15th. (Complete.)

26,287. "Telephone systems." E. A. Graham. November 15th. (Complete.)

26,288. "Telephone systems." E. A. Graham. November 15th. (Complete

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Electric Starters for Motors, Alternating or Direct Current. C. B. Pinkerton and A. E. Wason. 21,974. September 27th.

Holders for Electric Incandescent Lamps. W. E. Lake (Geb. Jaeger.) 24,154. October 22nd.

Signal Devices for Use on Motor Vehicles. H. P. E. Miller and E. Tetlow. 24,238. October 25th.

Condensation Products for Making Plastic Substances, Impregnating Solutions, and the Like. British Thomson-Houston Co. (General Electric Co.) 24,255. October 23rd.

Impulse Transmitters for Electrical Circuits. W. M. Bruce, Junr. 24,409. October 25th. (December 7th, 1911.)

Contact Breaker for Electric Bells and the Like. The Sterling Telephone and Electric Co., and F. G. Bell. 24,439. October 25th.

Cases for Electric Batteries Preserving Food and other Purposes. H. F. Joel, Senr. 24,443. October 25th.)

Electric Reversing Switches for Electro-Magnetic Ratchet Feeding Devices. G. A. Vassberg. 24,550. October 26th.

Electric Oven. Simplex Conduits Ltd., and F. G. Taylor. 24,586. October 28th.

Power Transmission. J. G. P. Thomas and Thomas Transmission Ltd. 24,618. October 28th.

Mariners' Compasses. L. W. P. Chetwynd. 24,768. October 29th.

Lamp Jack Strips for Telephone Switch Boards and the Like. Siemens Bros. & Co., Ltd., and E. A. Petithory. 25,237. November 4th.

Alternators Particularly Applicable to Radio-Telegraphy. E. Girardeau. 25,356. November 5th. (November 6th, 1911.)

Means of Communicating with Submarines or other Vessels when Submerged. A. Turpin and R. Robinson. 25,499. November 7th.

Manufacture of Objects from Molybdenum. Chemische Fabrik von Heyden Akt. Ges. 25,976. November 12th. (June 19th, 1912.)

Electric Igniting Means for Gas Burners. South Metropolitan Gas Co., and J. M. Somerville. 26,156. November 14th.

Dynamos and other Like Electric Machines. G. Plaisant. 26,177. November 14th. (November 24th, 1911.)

Method of and Means for Testing the Electrical Resistances of Metal Bodies. C. Sarel. 26,639. November 20th.

Solenoids for Alternating Current. C. G. Major and Smith, Major & Stevens, Ltd. 26,935. November 23rd.

Regulating Mechanism for Electric Distribution Systems. British Thomson-Houston Co., E. Garton and A. H. St. C. Watson. 27,758. December 2nd.

Magneto Electric Machines. R. C. Staunton. 28,469. December 10th.

Tube Coupling for Electrical Circuits. J. H. Jackson. 28,929. December 16th.

Conduits for Eletric Conductors. H. G. Coventry and G. Rushton. 28,979. December 16th.

Reflectors and Shades for Indirect Lighting. H. Hirst and T. C. Cash. 29,348. December 20th.

Adjustable Electric Lamps. H. Fairbrother. (Vesta Accumulator Co.) 29,698. December 24th.

Electro-dynamoter Instruments. J. T. Irwin. 27,348. November 28th.

Galvanic Batteries. A. F. Hawdon. 27,351. November 28th.

Electric Lamp Holders. M. J. Railing and J. H. Collings. 27,503. November 29th.

1913.

Systems of Voltage Regulation for Electric Circuits. A. H. Olmsted. 1,207. January 15th.

Incandescent Arc Electric Lamps. M. S. Okun. 2,125. January 27th. (January 26th, 1912.)

Electrodes for Electric Accumulators. H. F. Joel, Senr. 2,269. (Divided Application on 24,443/12. October 25th.) January 28th.

Circuit Arrangements for Telephone Exchanges. Siemens & Halske Akt. Ges. 3,132. February 6th. (February 6th, 1912.)

Means for Signalling Disagreement between Engine, Controlling Gear and the Like and Order Telegraph Indications. J. V. Fowler. 3,266. February 7th.

Telegraph System Unaffected by Static Charges from Neighbouring High-tension Lines. Siemens & Halske Akt. Ges. 3,432. February 10th. (February 12th, 1912.)

Sockets for Incandescent Electric Lamps. H. Hubbell. 3,656. February 12th.

Device for Assisting in Setting or Timing the Ignition and Valves of Internal-Combustion Engines. W. H. Leek and A. J. Wilesmith. 4,239. December 19th. (Cognate Application 8,450/13.)

Electric Contact Makers for Use with Resistance Boxes, Wheatstone Bridges, and the Like. T. E. Gambrell. 4,862. February 26th. June 2nd, 1913.)

Electric Circuit Interrupting Devices. British Thomson-Houston Co. (General Electric Co.) 4,945. February 26th.

Method and Means for Starting Four-stroke-cycle Diesel Motors. J. M. Bukh. 5,309. March 3rd. (May 18th, 1912.)

Electric Fuse-holders. Electric and Ordnance Accessories Co., and E. Howell. 5,836. March 10th.

Electrostatic Separators. J. Kraus and E. Oppen. 6,336. March 14th. (March 14th, 1912.)

Ignition Devices for Internal Combustion Engines. W. Burton and L. J. Yates. 6,434. March 15th.

Process and Apparatus for the Production of Copper by Electrolysis. M. Perreur-Lloyd. 6,897. March 20th. (March 22nd, 1912.)

Electric Current Generators. F. W. Howorth. (Ryder.) 9,070. April 17th.

Reflectors. W. H. Gwynn and H. E. Clerk. 10,152. April 30th.

Wireless Telephony. F. Majorana. 10,153. April 30th.

Safety Signalling-apparatus for Use in Mines. R. Nelson. 11,166. May 13th.

Electric Cut-outs with Multiple Safety Fuses. F. Despessailles. 11,850. (March 31st, 1913.) May 21st.

Vapour Electric Devices. F. Conrad. 12471. May 28th. (June 21st, 1912.)

Night-sights for Rifles and the Like. F. A. Schanz. 12,549. May 29th.

Electric Arc-Lamps. Siemens Bros. Dynamo Works, Ltd. (Siemen-Schuckert-werke Ges.) 12,575. May 29th.

Protection of Alternating Current Electric Motors. G. Ellison. 12710. May 31st. (Addition to 13285/07.)

Timing Gear in Electric Ignition Devices. W. Ruthardt. 12871. June 4th.